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INDUSTRIAL ILLUMINATION.

At the recent meeting of the New York section of the Illuminating Engineering Society, an interesting discussion was occasioned by the reading of the paper entitled "Industrial Plant Illumination," by Mr. G. C. Keech. This paper, an abstract of which will be printed in a later issue of this journal, gives the results of comparative tests in various places of the illumination obtained when employing mercury vapor lamps, metallized filament clusters, and several types of arc lamp. These tests are exceedingly instructive, not only because they show results actually obtained in the different installations examined, but because they demonstrate how important it is to make a careful study of illumination problems, and how many conditions there are entering into each one which require attention. It is, of course, a comparatively simple matter to determine the amount of light given out by each illuminant under consideration and the character of the distribution, and from these figures it is not hard to show that if the lamps be placed in such and such places the amount of light falling upon such and such points should be so much. Knowing how much light is desirable, one can then attack the problem intelligently, and be fairly confident of obtaining a satisfactory result; yet it should be remembered that there are various uncertain features entering into each problem. In the first place, we do not yet know just how much light is best for each and every condition. The judgment of the engineer is here brought into play, and he can usually come to some idea of what is needed. Next, the lamp itself introduces uncertainties. It is impossible to prevent variation in the lamps, and it is impossible to prevent them from changing after they are put in, due either to inherent peculiarities of the lamp or to its surroundings. And although we may know how much light may be thrown in a particular place, unless we know what this light falls upon, we can not say whether the illumination will be just right. At present we are therefore working under many disadvantages, but, fortunately, due to the great interest which has been aroused in this phase of engineering, we are making most satisfactory progress. It is all important, however, to collect as many data as we can from installations of all kinds, whether satisfactory or not, and from these it should be possible to decide upon a certain minimum illumination which will be satisfactory under favorable conditions and then, by means of a factor of safety, provide that under all ordinary variations in the room lighted, the light will be sufficient. This can be done without introducing any disadvantage, except possibly an increase in the first cost, because, when there is too much light for the work in hand, it is always

possible to reduce it. When the character of the work does not change from day to day it would be allowable to work closer to the minimum figure, but it should never be forgotten that, due to dust and dirt and other factors which are too frequently neglected, the amount of light given by any lamp may be reduced from ten to twenty per cent or more. On the other hand, to solve a problem simply by providing an abundance of light and to expect this to be used all the time is crude, to say the least. In many instances the result would be decidedly bad.

In studies of this kind it is legitimate to make comparison between different installations, provided, of course, the character of each be clearly explained. When this is done, no objection can be raised, though the results must not be applied broadly; but it should be clearly understood just what were the conditions under which each test was made.

In such measurements the instrument employed is an illuminometer, which is really nothing more than a portable photometer, the latter instrument itself being really an illuminometer, strictly speaking, because it determines the amount of light falling upon and illuminating the photometer screen. In discussing this instrument, a very interesting point was brought out by Mr. E. L. Elliott, who said that recent advance in the design of illuminometers owed much to the introduction of new high-efficiency, low-resistance incandescent lamp filaments, as these made possible the use of an incandescent standard which could be operated from a truly portable storage battery. The low voltage and small amount of current required by these lamps have reduced the battery to a size easily carried.

THE FLICKER PHOTOMETER.

The flicker photometer, when introduced, seemed to offer advantages enjoyed by no other instrument. It depends for its action upon a peculiar effect to which the eye is more or less sensitive, and did away with the necessity for comparing two surfaces. In other words, surfaces illuminated by the two sources being compared are brought alternately into the field of vision. When illumination on the two surfaces is equal, no variation is seen, and the flicker disappears. The means by which this may be done are various.

There has been some question, however, whether this instrument is a true photometer—that is to say, whether the effect produced in the eye by the flickering surface is proportional to the illumination of the surface, or whether other effects may not creep in, and thus vitiate the measurement. There are many things entering into this question which make it very complicated and hard to investigate. It is for this reason interesting to note two recent papers which have some bearing on the subject. One of these was presented by Messrs. A. E. Kennelly and S. E. Whiting at the recent convention of the National Electric Light Association, the title being "The Frequency at Which Variations in Illumination Vanish." The other is a paper contributed to the London *Electrician* for May 31 by Mr. J. S. Dow, on "The Speed of Flicker Photometers."

The former paper gives the results of an investigation to determine at what frequency of flicker this effect disappears and the eye perceives a uniformly illuminated surface. The work was done first by determining the illumination on a certain surface, and then measuring the speed at which various degrees of variation in the intensity of this illumination could not be perceived. As might have been expected, it was found that these speeds vary with the intensity of illumination. The greater the latter, the higher must the speed be. They also depend upon the amount of the variation. But they do not seem to depend upon the way in which the variation takes place—that is to say, upon the wave-form of the variation. It was noticed that the area of the surface illuminated also had some effect, the larger this, the higher the speed required to get rid of the flicker. This was possibly due to the larger area of the retina affected by the flicker, although it may be possible that the different parts of the retina are more sensitive to this effect. For example, with a sixteen-candle-power incandescent lamp operating at twenty-five cycles, the flicker may not be noticeable when the eye is turned toward the lamp. If, however, it be turned so that it does not look directly at the lamp, but sees the lamp only on one side, the flicker becomes very noticeable. It is also probable that the intrinsic brilliancy of the source would itself play some part in this effect, and that, by dazzling and fatiguing the eye when looked at directly, it would mask the flicker. On the other hand, Dr. Kennelly found that if a lamp be viewed directly through the rotating screen, the flicker can only be caused to vanish at very high speeds.

Another feature examined in this paper was the effect of using screens of different color. It was found that with a red screen the vanishing frequency of the flicker was lower than that for a white screen. This might be due to the less amount of light sent into the eye from the red screen than from a white screen receiving the same amount of light, but it is possible that the effect of the behavior of the eye toward red light may have some effect, as the after image is more easily produced by red light than any other. It was this feature that led Dr. Steinmetz to question the suitability of the flicker photometer for comparing light differing in color.

The paper by Mr. J. S. Dow takes up a different phase of the subject. In this it was sought to determine the frequency of the flicker to which the eye is most sensitive, and, as might have been expected, it was found that this frequency varies with the intensity of the illumination and also with the color of the screen. A peculiar screen consisting of a rotating Bunsen grease-spot disc was employed. The measurements were made by determining how far this screen could be shifted out of balance before the flicker became imperceptible. The results show that for the highest sensibilities the frequency varies considerably; that with an illumination of twenty candle-metres there is a considerable range, varying from 1,250 to 1,400 variations per minute. With lower illuminations such as two candle-metres, the range is less, and the frequency is lower. Here the range is from about 975 to 1,050. At the lower illumination, however, the sensitiveness is less—that is to say, the screen

may be moved a greater distance on the bench before the flicker becomes perceptible. The sensitiveness is also decreased when the two lights being compared differ in color; but there is an additional difficulty introduced here, as the difference in color itself tends to produce a flicker, as well as a difference in intensity of illumination. The author concludes that the instrument, however, is fairly satisfactory, giving results within a few per cent, but points out that this accuracy will vary with different observers, and from day to day, as it is affected markedly by the fatigue of the observer.

Both papers here alluded to give valuable information respecting this new instrument, and both seem to show that, as far as these particular phases of the problem are concerned, that the flicker photometer is a fairly satisfactory instrument.

SPECIFICATIONS FOR STREET LIGHTING.

At the convention of the National Electric Light Association, held recently at Washington, D. C., among the reports of committees was one report of particular importance. This was presented by the Committee to Consider Specifications for Street Lighting, and after some discussion and criticism, the report was finally accepted.

Undoubtedly, the report, as accepted, constitutes a decided step forward. Heretofore the lighting companies have been forced either to make indefinite contracts for street lighting, or have made use of the specification adopted by the association in 1894. That specification has served a good purpose, and although it states definitely what the lighting company will do, it does not say what the illumination thus secured will be. The difficulty encountered in preparing a satisfactory specification is twofold. In the first place, to draw up a specification which states that a definite illumination should be given would convey but little information to those contracting for light, and would open the door to endless controversy, since, at the time the earlier specification was drawn up, there was no satisfactory instrument at hand for making such measurements. On the other hand, it was not easy to define the illumination which should be given by the street lamp. Although open-arc lamps consuming about the same power give somewhere near the same amount of light, this may vary due to different causes, such, for example, as the character of the carbons. It was to avoid these difficulties that a specification defining the lamp in terms of the power it consumed was adopted, and this solution of the problem was fairly satisfactory, because, at that time practically but one type of lamp was under consideration. So far, however, as conveying any definite information to the purchaser, the specification was sadly lacking.

Until recently it was possible to get along under the old conditions, although the enclosed-arc lamp came into use, which does not give the same amount of light as the open-arc lamp which was under consideration when the specification was drawn up. But since the bringing of the newer types of arc lamps to a practical stage, and the introduction of other illuminants suitable for street lighting, such as the high-candle-power series incandescent lamps and others, the old specification has become wofully inadequate. It was therefore highly desirable that some action should be taken which would enable the lighting company to state definitely what it was prepared to do. This result seems to be accomplished in the new specification, as just adopted.

In preparing the new specification, all the difficulties met when the earlier one was drawn up were again encountered, and others brought in by the new lamps. A specification, therefore, which would simply say that the company would furnish so much power for each lamp would rule out the more economical lamps. If it were attempted to define the total amount of light which should be given by the lamp, those lamps peculiarly adapted to street lighting purposes would be at a disadvantage. Moreover, as mentioned above, such a specification would merely invite trouble, because photometry, even under the best conditions, is difficult and uncertain, that is, as compared with other engineering measurements. It thus seems that the new report has found a neat solution of the problem, and it sets a condition which is easily determined. A study of the distribution characteristics of the principal street lamps shows that they give out their maximum illumination within a comparatively narrow zone which includes the direction in which it is most important that light be thrown—that is to say, a direction a little below horizontal. The solution then reduces merely to a measurement of the illumination on a test plane at a specified distance from the lamp, this distance, of course, to be defined in the contract. To avoid the uncertainty and misunderstandings likely to occur if the term "candle-feet" were embodied in this measurement, the latter is to be made merely in terms of a standard sixteen-candle-power lamp—that is to say, the contract will state that on a certain surface, placed in a certain position a certain distance away, an amount of light will be delivered which will be equivalent to that given by a sixteen-candle-power lamp placed at a certain distance from this surface. There is, of course, no uncertainty concerning a sixteen-candle-power lamp, but this is further defined as a lamp giving sixteen candles in a certain definite direction.

As Dr. Steinmetz said in his explanation of the specification, it is difficult to see how anything could be added to make it more definite. Every one has some idea of the amount of light given by a sixteen-candle-power lamp, and it is easy for any one to determine what the illumination offered will be. It might seem at first that the specification was unjust to certain types of lamp which give a nearly uniform spherical or hemispherical distribution; yet it seems only proper that, for street lighting, those types of lamp which give the most suitable distribution should be given the advantage. The distribution of others can, of course, be altered by the use of shades and reflectors; in fact, it is hardly probable that any street lamp will be employed without some such device. Moreover, the specification, while it is to be definitely drawn up, is sufficiently flexible for any company to offer any kind of illuminant to its users, and yet to define what the illumination produced by it will be. Undoubtedly, this specification will aid in introducing the newer forms of street lamps, and, at the same time, will assist in avoiding endless and expensive controversy after the system has been installed.

The Valle Brembana (Italy) Electric Railroad.

By C. L. Durand.

A LINE of single-phase electric railroad has been recently opened for traffic in Italy, and it presents many interesting features. The starting point of the present line is the old town of Bergamo, which is located at the junction of the valley of the Brembo river and the valley of the Serio. The valley of the Brembo, or Valle Brembana, lying between two ramifications of the Alps, is one of the most picturesque which is to be found in the upper Italian region. A number of villages of some size are disseminated along the valley, among which is San Pellegrino, and this point is one of the most frequented summer watering places in Italy. Owing to the development of the region and the large passenger traffic which was to be secured during the summer season, the need of a railroad was much felt for some time past, and this had only been delayed on account of the difficulties of construction which it presented. The present railroad line is a very successful solution of the problem, and is of interest as being one of the first applications of the Westinghouse single-phase system on the Continent. All of the electrical outfit for the central station and the line has been built at the company's works at Havre.

The Valle Brembana line connects the town of Bergamo, which lies at 810 feet altitude above sea level, with the village of San Giovanni Bianco (1,310 feet altitude), the total length of the line between these two localities being very nearly twenty miles. In addition to the two terminal stations of the road there are seven intermediate stations along the line. All the stations are provided with side tracks and have all the facilities which are needed to handle the freight traffic, which is already considerable and is expected to increase in the future. It is expected also to increase the number of stations on the road as soon as the traffic requires it.

As regards the track construction which has been here adopted, it is of standard gauge, 1.44 metres, such as is generally in use on the Continent, with rails weighing fifty-five pounds per yard. The minimum radius of the curves is 800 feet, and the highest grade is 2.4 per cent, the latter occurring upon a stretch of over half a mile. Owing to the broken character of the region which is traversed by the road, a number of tunnel and bridge constructions had to be used. In all there are as many as seventeen tunnels on the whole length of the road, and some of the tunnels are nearly 650 feet in length. Owing to the numerous waterfalls, which are to be found in the region, it was decided to use hydraulic power for supplying the current in the present case. After examining the different systems of power distribution and electric traction which could be successfully applied in the present case, the Societa per la Ferrovia Elettrica di Valle Brembana, which controls the line, decided to adopt the project which was presented by the Societe Anonyme Westinghouse and based upon the use of locomotives and trailers with motors operated on the single-phase system at twenty-five cycles. The main lines of the project are as follows: The central station, situated at a point lying 3,000 feet above San Giovanni Bianco, is equipped with a turbine outfit for supplying single-phase current at twenty-five cycles and 6,000 volts. The current is distributed to the locomotives of the road by means of a trolley line working at 6,000 volts. Upon the locomotives are mounted transformers which are used to lower the voltage from 6,000 to 250 volts, and the latter current is supplied to the motors.

The usual method of rail return is employed in this case, and the rails are bonded for the purpose. As at present designed, the plant has the advantage of a great simplicity when compared with most of the electric traction systems which are in use at the present time. One of the principal advantages lies in the fact that the substations containing rotary converter groups such as would be needed for the direct-current system, are now suppressed. Another point is that the double overhead line used in the three-phase plants is replaced by a single line, as regards the trolley construction, and it is found that as high as 6,000 volts can be used on this wire without occasioning any trouble, and if necessary the voltage could even be raised to 12,000 volts, as shown by different experiments, without giving any danger. As regards the details of the new system, the following description will give an idea of the leading methods which have been adopted, while the type of locomotive and train, as well as the arrangement of the trolley and overhead wiring are noticed in the different illustrations which accompany the text.

VALLE BREMBANA ELECTRIC RAILWAY. IRON POLE CONSTRUCTION.

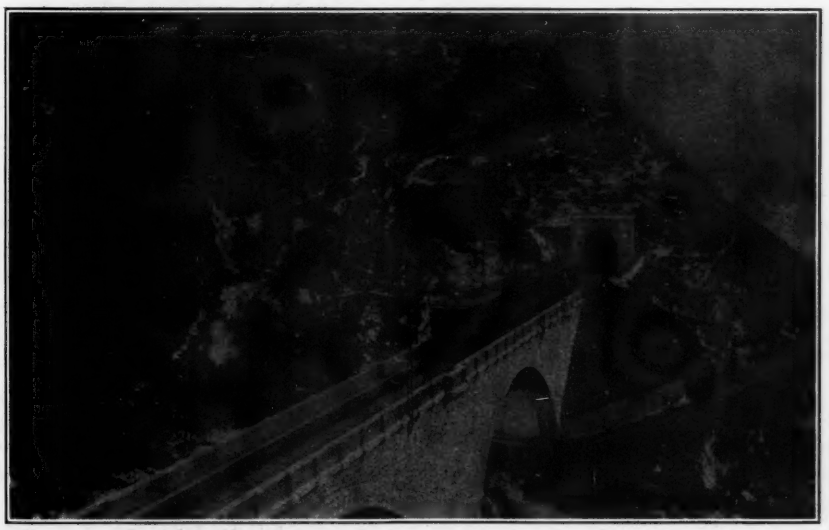
Beginning with a short account of the central hydroelectric plant, it is situated at about 3,200 feet above the railroad station of San Giovanni Bianco, and makes use of a fall of eighty-five feet, the latter being obtained by the hydraulic work carried out upon the Brembo stream. Besides the three generating groups of 500 kilowatts which are used for the electric railroad, the turbine plant also contains a small direct-coupled group for the electric lighting of the railroad stations. To furnish the exciting current for the main alternator sets, the station is equipped with three turbine-generator sets of small

size which are designed to deliver current at 110 volts for this purpose.

As to the main alternator sets, which give single-phase current for the railroad line, the three groups are of a uniform design, and consist of a turbine built by

VALLE BREMBANA ELECTRIC LINE, SHOWING WOODEN POLE CONSTRUCTION AND TROLLEY SUSPENSION.

one of the leading Italian houses, Riva Monneret & Company, of Milan, and provided with the company's standard type of oil-pressure governor apparatus, coupled direct to an alternator of the Westinghouse type. The latter machine has six poles, and is operated at 6,000 volts and twenty-five cycles, using the revolving field



A SCENE ON THE VALLE BREMBANA (ITALY) ELECTRIC RAILWAY.

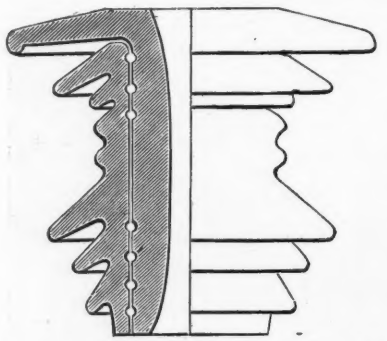
design with an exterior armature ring. The turbine and alternator shafts are coupled by a semi-elastic coupling joint of a new design. Current for exciting the three alternators comes from the three exciting groups mentioned above. These machines are operated at a standard speed of 1,000 revolutions per minute, and are rated at thirty kilowatts each, giving a voltage of 110 volts at the exciter bars. In order to render the electric lighting service of the railroad stations quite independent of the traction service, a small single-phase alternator working at twenty-five cycles is mounted in the station, carrying its exciter upon the shaft. This group is rated at fifty kilowatts, and is operated at 700 revolutions per minute. The frequency and voltage of the lighting system were chosen so as to be about the same as for the traction service, so that if desired later on, the current from the main alternator sets of 500 kilowatts can be used for the lighting system as well. The switchboard arrangements of the station have been well carried out. Near each of the machines is mounted a metallic column which carries the switches and instruments needed for operating each of the units. Oil switches are employed in the case of the 6,000-volt alternating current, and in the present plant they are operated from a distant point by means of an electromagnetic device, the magnets using the direct current from the exciter circuits. In order to secure the best regulation of the voltage of the main alternators the plant is equipped with a regulator of the Tirril pattern, which works on the principle of putting the rheostat of the exciter in short-circuit when the voltage falls below the normal. In this way a practically constant voltage is secured upon the bus-bars of the station, whatever may be the load and the power-factor. The main wiring of the plant is well disposed in the basement of the building. Bare copper bars are employed in general, mounted upon insulators. A tower placed on one side of the building is used to contain the starting point of the overhead lines leaving the station. In the different stories of this tower are placed the main switches for high voltage as well as the lightning arresters.

Coming to the arrangement of the high-tension overhead lines which supply the railroad, we may state that aside from the small line which connects the central station with the San Giovanni Bianco depot, the lines comprise four distinct parts, first, the main trolley line, which consists of a 0.32-inch copper wire; second, a feeder having the same section as the former and mounted on the same poles; third, the return circuit, which is formed by the bonded rails of the track; fourth, the electric lighting line, which is formed of two 0.16-inch copper wires. As will be noticed in the engravings, the trolley wire of the track is suspended from the cross hangers of the poles by what is known as the catenary system, with the use of a second supporting wire. Its height is 18.5 feet above the rail level. The second or carrying cable is formed of seven strands of steel wire, each having a diameter of 0.08 inch. Injected wood poles are used to hold the trolley wire and feeder line, at least for the greater part of the distance. The poles are treated in this case with bichloride of mercury. Normally the line is held by cross-bars which run between each pair of poles. However, in certain special cases it has been found necessary to use brackets which have the same section and form as the cross-bars. Again, on the bridges, the wood poles have been replaced by a metallic pole and cross-bar, as will be noticed in one of the views of the line. At the railroad stations, owing to the short distance between the tracks,

the intermediate poles had to be suppressed in many cases, and there is a main pole at each side which carries a cross-bridge of trellis work, and from this the different trolley wires are suspended. The cross beam has a length of sixty feet in some of the larger stations. As to the section of the trolley wire, this is not round as usual, but is of the figure 8 section which is coming into use in different plants on the Continent, and the trolley wire is suspended from the upper carrying wire by strips of flat iron carrying malleable iron jaws at each end. The length of span for the wire is here about 115 feet, allowing a drop for the carrying cable of thirty per cent, which corresponds to a tension of 990 pounds at the freezing point. Each span is provided with fourteen of these hangers. Where the railroad is in curve, the spans are shortened up so that the trolley wire does not fall out of the centre line of the track by more than fifty per cent. The suspension plane of the hanging wires is kept in the vertical by means of stay cables placed at intervals and well insulated. A similar arrangement is also used at intervals along the straight track, with a special form of arm which prevents the trolley wire from swinging from side to side about the suspension wire. Where the overhead line is fixed to the cross-arm there are placed two insulators of special design. These insulators are made to resist a continuous application of 15,000 volts and are thus tested under an artificial rain. They also stand an instantaneous tension of 50,000 volts. As will be noticed, these two insulators are fixed at the upper part of an iron bar which is made up of two channel beams of 2.4 inches height and weighing ten pounds per yard.

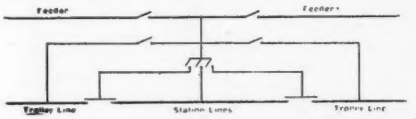
In the tunnels, the suspension points of the trolley line are regulated at fifty feet distance in the vaulting, and in this case the height of the line above the level of the rail is 14.5 feet. The feeder above mentioned, and having an area of 100,000 circular mils, is connected in parallel with the trolley line as usual, and it is especially designed so as to allow repair work to be carried out on different sections of the track without cutting off the current entirely. In all the station yards are placed section posts mounted upon trellis-work towers, and these allow either the trolley wire or the feeder to be cut out of circuit in case of need. The oil switches which are used in this case are worked from a distance by a suitable device and can be operated by an ordinary workman. When one of the two sections ending at a railroad station is cut out, it is necessary to cut off all current from the trolley wire of the same station.

The electric locomotives are designed in the present case so that they can be coupled together in pairs, and in this case the distance between the two trolleys is about thirty-five feet. If one of the trol-



TYPE OF INSULATOR USED FOR CARRYING SUPPORTING CABLE AND TROLLEY WIRE.

leys were upon the section preceding the station and the second trolley in the station itself, should the locomotives not be using current the tension of one of the sections would be communicated to the other by means of the trolleys and controller circuits. In order to avoid this, there is provided a safety arrangement in the shape of a neutral wire about forty feet in length, which avoids the possibility of having the voltage placed upon a section of the line where the workmen might be engaged in making repairs. As regards the method which is used for the rail return, each line of rails is connected by means of Chicago rail bonds having a section of 100,000 circular mils. In the switches, these connections are made by means of copper cables having a much higher section. Grounding of the rails is



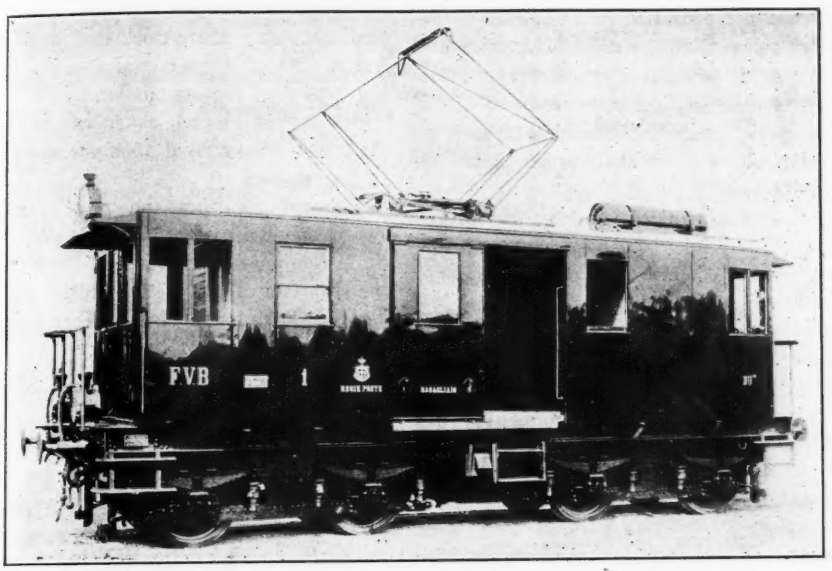
ELECTRICAL CONNECTIONS AT EACH RAILWAY STATION.

carried out by plates of galvanized iron which are buried about six feet in the ground, and such plates are placed along the track at distances of half a mile or more.

The different views which are here presented will give an idea of the rolling stock which is used on the single-phase line, as regards the electric locomotives and the trains. One of the engravings gives a detailed view of one of the standard trucks of the locomotive. Freight and passenger service is handled at present by five electric locomotives of the double-truck type. These locomotives have four motors each. The mechanical part has been built at the shops of the Societa Ernesto Breda, one of the prominent Italian construction firms. Each of the four motors is of the seventy-five-horse-power Westinghouse single-phase type. Current is taken from the overhead wire by a pantagraph trolley of special design, which allows the locomotive to be run in either direction without needing any special maneuver. The cross-bar of the trolley is of aluminum and is applied against the overhead wire by means of metal springs placed in the trolley base. Here spiral springs are contained in a cylinder which is adapted for the purpose. By admitting compressed air into the cylinder, a piston is made to operate, and it acts upon the spiral springs, causing the trolley to be lowered. A locking device worked by compressed air allows the piston and consequently the trolley to be fixed in this position and thus the locomotive is cut off the line entirely. The reducing transformer, which each locomotive carries for lowering the 6,000 volts of the line to 250 volts for the motors, is an auto-transformer having a single coil with ends brought out so as to give the proper ratio. One of the terminals is connected to the rails, and the other to the trolley circuit. A good air cooling is furnished by a small electric fan which uses single-phase current at 100 volts, coming from special terminals of the transformer coil. Seeing that the potential of the transformer coil starts at the ground end at zero and increases at each turn, reaching finally the potential of the trolley, or 6,000 volts, the method of regulating the voltage by the controller upon the motors which is used here is a simple one, and consists of connecting the motors between ground and different points which are chosen upon the transformer winding. To carry this out in practice there are a certain number of ends brought out from the coil which serve to graduate the voltage at the motor terminals in the proper way, and the variation of voltage is thus secured without needing the use of rheostats and consequently without the losses which occur in the latter.

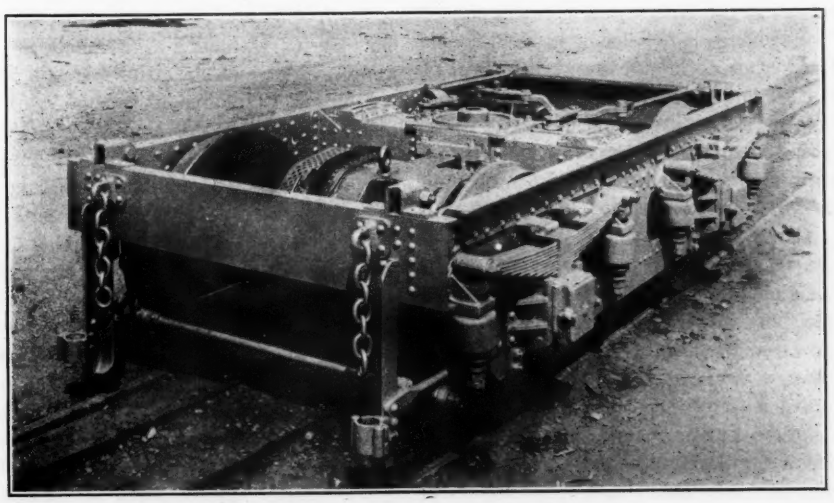
In order to pass from one of the current contacts to the other without breaking the circuit, or short-circuiting the windings between two such points, it was necessary to provide a device in the shape of a resistance-coil or choke-coil which balances the voltage of the turns which may be in short-circuit. Compressed air on an improved system is used to operate

the contact device of the controllers, and the air which is needed in this case is admitted to the pressure piston by means of valves having electromagnetic control, using fifty-volt single-phase current from the transformer. Such a device dispenses with the use of a storage battery carried upon the locomotive. The use of compressed air makes it quite easy to handle the entire controlling apparatus, and the motorman uses a small master controller which operates the circuit of the electromagnetic valves.



The Electric Locomotive on the Valle Brembana Electric Railway.

The motors are designed to operate at 700 revolutions per minute and will give seventy-five horse-power. By means of single-reduction gearing they operate the main wheels of the locomotive, using a ratio of 15 to 70. About the same general form is used for the single-phase as for the direct-current motors; they are of the series type with commutator, and provided with a compensating winding. A number of special arrangements is used to make them work to the best advantage. As to the field circuits, their number is doubled in the present case. The first of these is the usual series field-winding, and the second is what is known as the compensating winding, and the latter gives rise to a magnetic flux which is perpendicular to the flux produced by the first winding. On the other hand, when an armature turn is put in short-circuit by means of the commutator brush, a short-circuit would be produced owing to the conditions of the flux, and this current might be quite strong. In order to limit such currents to a proper degree, and to avoid undue sparking at the brushes from this cause, the connections between the armature coils and the commutator bars are made by means of high-resistance German silver wires laid in slots, and these wires are soldered at one end to the commutator bars and at the other to the ends of the armature coils. A system of equalizing rings is made to connect all the points of the armature which have the same potential, and in this way it is found that the sparking at the brushes is much lessened should the armature come out of centre.



Valle Brembana Electric Railway, Bogie and Motor.

Westinghouse air-brakes of a new type are used on the locomotives, and the air which is needed for the purpose is furnished by a small air-compressor driven by a single-phase 100-volt motor. The principal compressed air tank is mounted upon the roof of the locomotive, and other reservoirs, of smaller size, are placed in the interior. Upon the roof is also placed the lightning arrester, which is of the Wurts pattern. In order to carry out the lighting and heating of the cars, current at 500 volts is taken from a special terminal of the transformer.

The present type of locomotive is designed to take a 100-ton train between the stations of Bergamo and San Giovanni Bianco, and the highest speed can easily reach thirty-five miles an hour. Tests which were made upon the locomotives at the time when the road was started showed that upon a two per cent grade they were able to draw a heavy train of 130 tons at a speed of eleven miles an hour, and upon certain parts of the road the total weight of the train could be increased to 150 tons. Acceleration tests which were made with the trains showed that it was possible to obtain accelerations which reached and even exceeded twenty inches per second.

While the Valle Brembana railroad will not compare with the through railroad lines in its traffic or the tonnage of the trains, in many other respects it offers considerable interest, owing to the fact that it is one of the few standard-gauge railroads on the Continent to be operated on the single-phase system. It is to be noted in this connection that the scope of the present method might be increased so as to apply it to a road carrying a heavier traffic. This will be observed from the fact that the monophase system allows of equipping a locomotive of at least 1,000 horse-power quite easily, and again the trolley voltage of 6,000 volts is far from being the highest which can be used, and in fact can be increased to 12,000 volts, as was shown by conclusive experiments. The present line may be said to show on a small scale what could be done upon a more extensive system of railroad, and is one of the points to be taken into account by engineers in the consideration of the much-discussed problem of electric traction upon trunk lines of railroad.

Governor Hughes Signs Public Utilities Bill for New York.

Governor Hughes signed the Public Utilities Commissions bill at Albany, N. Y., on June 6, the fight in New York State over the now famous bill coming to an end when the Senate, on June 5, repassed the measure over the veto of George B. McClellan, mayor of New York city.

The Public Utilities Commissions bill divides the state into two districts, the counties constituting New York city, and the remaining counties of the state, and creates for each a commission of five members, with salaries at $15,000 a year; counsel at $10,000, a secretary at $6,000, and each commission has authority to appoint necessary clerks, inspectors, experts and employés and to fix their salaries. An appropriation of $150,000 for each commission is provided.

The commissioners must be residents of the districts for which they are appointed and must not hold any official relation to or hold stocks or bonds in corporations belonging to the class over which the commissions are to have jurisdiction. The term of office is five years, but the terms of office of the commissioners to be appointed first shall expire, respectively, on February 1, 1909, 1910, 1911, 1912 and 1913.

Salaries and expenses in the First district for others than the commissioners, their counsel and secretaries, shall be paid by the city of New York. Each commission must make an annual public report, with recommendations as to legislation and abstracts of reports to it of the corporations under its supervision.

Every corporation, person or common carrier engaged in the transportation of passengers, freight or property from one point to another in this state is required to furnish such service and facilities as shall be safe and adequate and in all respects just and reasonable. The charges made or demanded for such service shall be just and reasonable and not more than allowed by law or by order of the commission having jurisdiction, and every unjust and unreasonable charge is prohibited.

No common carrier shall directly or indirectly by any form of rebate or otherwise obtain a greater or less compensation than it obtains from any other person or corporation for doing a like and contemporaneous service in the transportation of a like kind of traffic under substantially the same circumstances or condition, nor shall any undue or unreasonable preference or advantage be given to any person or corporation or locality or any particular description of traffic in any respect whatsoever, nor shall any prejudice or disadvantage be imposed.

No common carrier is to charge any greater compensation in the aggregate under substantially similar circumstances and conditions for a shorter than for a longer distance, but upon application and in special cases the commission may by order relieve a common carrier from this prohibition.

Every railroad or common carrier engaged in freight transportation shall, upon reasonable notice, furnish to shippers sufficient and suitable cars for the transportation of freight in carload lots, and every railroad corporation and street railroad corporation must have sufficient cars and motive power to meet all requirements for the transportation of passengers and property which may reasonably be anticipated, unless relieved by order of the commission.

Railroad corporations are required to furnish switch and sidetrack connections to shippers whenever they are reasonably practicable and can be put in with safety and the business therefor is sufficient to justify it. Common carriers are required to file with the commission and to keep open to the public schedules showing rates, fares and charges, and the forms in which the schedules are to be made up are to be prescribed by the commission, but are to conform as closely as possible to those required by the Interstate Commerce act.

No change is to be made in the schedule until after notice for a certain length of time. And no common carrier, after November 1, 1907, may engage in the transportation of passengers, freight or property until its schedules are filed and published.

Corporations under the supervision of the commissions may issue stocks, bonds or other evidence of indebtedness running for more than twelve months when necessary for the acquisition of property, the construction, completion, extension or improvement of their facilities or for the improvement or maintenance of its service or for the discharge or lawful refunding of their obligations, provided there shall have been obtained an order from the proper commission authorizing such issue and the amount thereof, and that it is reasonably required, but this provision is not to apply to any stocks or bonds duly approved by the present Board of Railroad Commissioners.

No railroad or street railroad corporation shall purchase or hold stock in another such corporation or common carrier unless so authorized by the commission. No other stock corporation shall purchase or hold more than ten per cent of the stock of railroad or street railroad corporations or common carriers, but this shall not apply where stock shall be transferred or held as collateral security with the consent of the commission.

Similar provisions as to stocks and franchises are imposed upon gas and electric companies.

The act abolishes the present State Board of Railroad Commissioners, the State Commission of Gas and Electricity, the Inspector of Gas Meters and the Rapid Transit Commission of New York city.

By the abolition of the latter board the extremely important powers and duties under the present Rapid Transit act are imposed on the commission for the First district.

A Permanent Leak Water Lightning Arrester.

A water lightning arrester constructed at the Treforest station of the South Wales Electrical Power Distribution Company, near Pontypridd, is described in the *Electrical Engineer*, London, May 31, by Lewis W. Dixon, who designed and installed it. Two horizontal water-pipes are provided for flow and return, which are connected to the neutral of the generators and the station earth-plate. To each of these pipes three vertical pipes of glass tubing are connected, joined at the top to a special piece of glass tubing shaped like an inverted U, having a glass bulb in the centre, into which the point from the line wire dips. Connection at this point is made water-tight by a conical plug of india-rubber. The flow and return through this loop of glass tubing represents a maximum resistance for one of the three lines of 700,000 ohms. There are three rising and three descending pipes. This resistance, with the potential of 6,800 volts that exists on the system, gives a leakage of about 100 amperes for each pipe. This resistance can be definitely altered if desired by connecting up any one of the rows of metal sockets which form the joints between the sections of glass tubing. The sections are provided with gun-metal stuffing box with rubber insertion and a cable connector for making ground connection if necessary. In this way the leakage current for each pipe may be varied from one-one-hundredth to one-twenty-fifth of an ampere. The lines, in addition to the water arrester, are protected by Wurts spark-gap arresters.

ECHOES FROM THE CONVENTION OF THE INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION.

SOME OF THE GOOD THINGS LEFT OUT OF THE REPORT PUBLISHED LAST WEEK.

Much matter of importance and interest was necessarily left out of the report of the convention of the International Independent Telephone Association, held at Chicago, Ill., June 4, 5, and 6, published last week. The following matter, supplementing that report, will be found of value to those interested in the independent telephone development:

Dr. W. A. Evans, commissioner of health of the city of Chicago, in welcoming the delegates, said:

"I regret, I am sure, more than you do, that you are not to be welcomed by the mayor of this city. The circumstances are such that it is not possible for him to be here this afternoon, and I, in his behalf and in the behalf of the citizens of this city, extend to you a welcome during the period of your convention here. I am told that the business interests represented stand for something over $300,000,000, and that there are 4,000,000 subscribers to your telephones and that you are representatives of that great organization which within a lifetime has converted this Middle West from a region uninhabited into a great hive of activity; of that enterprise that in America takes raw material entirely unworked and within the space of a generation converts it into great machines for the doing of great things, as has been done in the city which welcomes you here to-day. And therefore there is a certain significance in the meeting here of this organization, which, taking an industry unknown a quarter of a century ago and creating practically something out of nothing, has made of the telephone a great civilizing agency. We recognize, therefore, something of the responsibility of your organization, standing for what you do, and meeting in this city, which stands for that which you represent."

H. D. Critchfield, of Milwaukee, Wis., replying to Dr. Evans, said:

"Prior to 1895 I believe there were only about 5,000 independent telephones in use in the United States. Since that time upward of 4,000,000 of independent telephones have been installed in the country, and the number is increasing every day. In 1895, when the independent telephone movement started, there were in the United States 325,000 telephones, after eighteen years' development under one system. Since that time, because of the spirit of competition largely, the Bell interests have increased to 3,000,000 and the independents have about 4,000,000. The general impression with which every municipality has to contend is that the installation of a second company is a burden upon the community. A canvass of the directories of eight of the largest cities in the country, in which there is more than one company operating, shows a duplicate use by only twelve per cent of the users.

"The greatest growth in the history of the independent telephone business has been within the past year, 1906. The demand is not fully supplied, but is growing rapidly all the time.

"Now a word about Chicago. There are within 500 miles of Chicago 1,200,000 independent telephone subscribers who are anxious to get Chicago connections. Is there any good reason why, is there any commercial reason why the city of Chicago should not permit the people who use those independent telephones to do business with you? You go to considerable expense to advertise throughout this country to bring business to your city. Why not let the people who are begging to do business with you come in? No one has to-day two telephones unless it pays him financially. He only takes the second telephone when it is financially advantageous to do so. The result will be approximately twice as many telephones as now, upon the completion of the second exchange, and each exchange will carry a larger number of subscribers."

Following Mr. Critchfield, J. B. Hoge, president of the Association, presented some facts regarding the independent telephone movement, saying in part:

"The best information that I can obtain shows that there has been an increase in our system of more than 500,000 telephones during the past year. Franchises have been granted by overwhelming votes in the following large cities: Boston, Mass.; San Francisco, Cal.; Milwaukee, Wis.; Denver, Colo.; Omaha, Neb.; Springfield, Mass.; Nashville, Tenn.; and in a number of smaller cities, thus leaving but a few centres of population where the independents do not have adequate terminals arranged for.

"The year has been one of increased prosperity among the independent companies. I find that to-day a large majority of the companies are in a very much better financial condition; most of them have placed their properties on a dividend-paying basis, having decided to stop putting all their earnings into extensions and betterments as was the custom during the early days of independent development. Most of them, however, are content to pay reasonable dividends and then put a substantial surplus back into the properties for extensions and betterments. In almost all cases investigated I find this amount to be equivalent to from three to ten per cent on the capital stock of the company.

"Twelve cities with competition representing a population of over 2,000,000 show a development of one telephone for 7.4 population, while the same number of cities without competition, with a population of 650,000, show one telephone to 23.8 population, with very much higher rates and unsatisfactory service.

"There are in the United States to-day approximately 7,000,000 telephones, or about one to thirteen of the population. If we had one telephone to 7.4 of the population we would have at least 12,000,000 telephones, or approximately seventy-five per cent greater development than we have to-day, and I do not believe the telephone business in any of the large cities in the 7.4 class has been fully developed, with the possible exception of Los Angeles, which has one telephone to every four of population.

"Without organization the legislatures in many of the states would be inclined to pass measures unreasonable and unjust to our interests, not to impose a burden on us, but through lack of information on the part of those introducing them. For instance, compulsory interconnection bills have been introduced into a number of the legislatures during the past year, and the subject is being agitated by the press of almost every state where the independents have a strong foothold. In most of the central, western, northwestern and southwestern states bills have been introduced during the legislative sessions just closed, providing for compulsory connection. In states whose legislatures will not meet until next winter similar bills will be introduced. The officers of the various state associations should at once inaugurate a campaign of publicity, pointing out the injustice of compulsory connection, which is an interference with property rights, and would have a tendency to stop all further development of long-distance lines. Stockholders of local companies should be informed by the managers of their respective systems of the operating disadvantages incident to compulsory connection, so that they can present the independent side of the con-

troversy intelligently to their representatives in the state legislatures. In all matters pertaining to legislative affairs telephone operators should secure the cooperation of their stockholders, because from a political point of view they have more influence than the man actively engaged in the management of the business."

Concerning the organization work of the association, Assistant Secretary John W. Harney said:

"All necessary changes have been made to bring our card record of independent companies right up to date, and we have increased this list by 2,642, so that it contains at present the names of 10,042 companies, all of which are strictly independent, according to the best information obtainable.

"Great progress has been made in compiling maps during the past year. At present the association has on hand government post-route map with tracing of same ready for making blue prints of every state and territory in the Union. Information has been received from, and spotted on tracings for, forty-two states, and we can furnish printed maps or blueprints showing from forty to ninety per cent of the existing independent toll-line development for fifteen states and a special blue-print showing important long-distance connections in the territory from central Nebraska to the Atlantic seaboard and south to and including a part of Alabama.

"At present there are independent telephone associations in twenty-two states and Canada, and a number of new organizations pending; seventeen of the existing organizations, including Canada, have applied for membership in the International association. A number of others are considering the matter and may present their applications at this convention. The International association keeps in close touch with all of these organizations, whether members or not, and on matters of general interest all of them may be considered as affiliated with the International."

C. S. Norton, secretary of the Indiana Independent Telephone Association, in discussing the "Indiana Situation," said:

"The independent telephone business in Indiana was never stronger nor more firmly intrenched than it is to-day."

Mr. Norton then described the unsuccessful efforts which had been made to effect a working arrangement of the independent interests in Indiana with the Central Union Telephone Company. Continuing, he said:

"There will always be more or less competition in the telephone business, dependent entirely upon conditions which may or may not necessitate competition. The same conditions that govern competition and absence of competition in other lines of business will ultimately control in the telephone field.

"The telephone is no more a natural monopoly than railroading or the printing of newspapers is a natural monopoly. A town that can support only one newspaper need not hope for competition in the price of newspapers or in advertising rates. If a city is large enough to support two daily papers, the merchant in that city who desires to reach all the people with his advertisement must patronize the advertising columns of both papers and pay for both. No one newspaper or railroad can adequately serve the public in our larger cities. It is a mechanical and human impossibility. It may serve them properly in the smaller cities and towns—conditions are different.

"So with the telephone business. While one company may answer all of the requirements of the towns and smaller cities, no one company can ever properly serve cities like Chicago, New York, Boston, St. Louis and Indianapolis."

"The Strength of the Chain" was the subject of an able paper by J. S. Brailey, Jr., of the United States Telephone Company, Toledo, Ohio. Mr. Brailey said in part:

"The strength of the chain in the independent telephone movement represented by our association is our organization. The chain represents the business of the independent telephone companies in this association and in the United States, and the strength and the foundation of the independent telephone business is our organization. In every link in the chain, every part of the chain, the strength is organization. Our organization, including the independent telephone interests of this country, to my mind represents two principal ideas. The first idea is the protection of our telephone business and the protection of the members of this association. During the time that the independent telephone movement has been in existence we have had some sort of organization, not the perfect organization that we have to-day, but we have always had some sort of organization and these various organizations are growing stronger and stronger. In fact the reason that we are here to-day, the reason that we have independent telephone companies to-day, is because we have always had some sort of an organization. Why, while I represent one or two fairly large companies, those companies could not prosper without organization, or without this association have accomplished what they have. What is a little railway system in this country to-day? Nothing whatever unless it is coupled up with some larger and more expensive system. And so, gentlemen, the first duty, I believe, of this organization is to defend the independent telephone business and defend each and every company represented in the association. I believe the second duty of this organization is to strengthen the chain of the independent telephone business, the business which we are interested in. The three hundred millions of dollars which is invested in the independent telephone business of this country is invested in the finest business in the world, and I believe it to be the duty of this association at all times and in every possible way to help and assist in advertising and upbuilding the telephone business. There are railroad business, gas business, oil business, etc., but the best business of all is the telephone business."

On the subject, "How to Handle Long-Distance Business," Frank Hart, of Pittsburg, Pa., said:

"The long-distance business of the independent telephone companies is increasing so rapidly that it is crowding the circuit capacity, making it necessary to handle the business so as to get the greatest amount possible over the lines. In order to do this there should be a general system of rules under which the various companies operate so that they will work in harmony. The author suggests that good work can be done along this line by the International Independent Telephone Association adopting a set of rules governing the handling of long-distance business and having them printed in book form, thereby being able to furnish them at a small cost to the companies and making it possible for the smaller companies who only require a few books to secure them without going to the expense of having them printed. By having the International Independent Telephone Association adopt the rules it would make them authoritative and would be the means of settling many a dispute between companies as to the right of lines, etc.

"The rules used by the large companies are much the same. There are cases where the originating operator works up the line to the point desired, while other companies

relay the message, and there are other slight changes too numerous to mention, the merits of which are dependent largely on local conditions. Better results would be accomplished by a universal system."

J. B. Earle, of Waco, Tex., reading a paper on "Telephone Legislation in Texas," said:

"When the Texas legislature convened in January, of this year, two or three bills were introduced affecting telephone properties, one of which required all telephone companies to connect with all other companies of every kind, competing exchanges, competing long-distance lines and lines that were not competing. This measure was bitterly opposed by the Southwestern Telephone and Telegraph Company as well as by the independents, all companies preferring to be left alone to make their own contracts for connection. The telephone companies were given ample time to discuss this matter before the committee on corporations, and the result was the bill was killed in committee, but a substitute was reported by a majority of the committee, proposing to compel a connection between companies at common points for such business as originated at a point where only one company had an office and terminating at a point where only the other company had an office; that is, to take care of non-competitive business. Another bill was proposed and offered as a substitute for this allowing either company, if it so desired, to go into the district court and on the merits of the case have an order entered by the district judge setting forth whether or not a connection should be made, and, if so, the terms and conditions. These bills were never reached at the regular session. When the special session of the legislature was called a bill was passed. This bill, as passed, provides that telephone and telegraph companies shall be compelled to make physical connection between their toll lines at common points for the transmission of messages or conversations, from one line to another. Such connections to be made between the switchboards of such companies, if any are maintained at such points, and provides 'that no telephone or telegraph company, under the provisions of this act, be compelled to receive from the wires or lines of any other company and carry to its final destination any message originating at any point on its own lines.' The bill went into effect on May 12 last.

"The attitude of the Bell telephone system toward the independents in Texas and that of the independents toward the Bell system renders it very improbable that either company will ever make application for this connection.

"There was another law placed upon the statute books during the last session of our legislature just adjourned, known as the anti-pass bill, which applies to railroads, street-cars, interurban, express and sleeping-cars, telephone and telegraph companies, preventing discrimination at least in long-distance service."

A valuable paper showing the status of independent telephone securities, entitled "Independent Telephone Securities as an Investment," by William L. Moellering, of Fort Wayne, Ind., presented the following paragraphs:

"Any enterprise launched under unbroken bright skies may reach a point where it becomes inviting to investors, but until it has successfully withstood the test of adverse conditions, usually sure to come, its enduring ability to pay dividends and keep its principal unimpaired is a matter of conjecture.

"Viewed from the standpoint of failures independent telephone securities are noticeably strong, the per cent of failures as compared with other industries being strikingly small. There are in the United States over 7,000 independent telephone companies with a capitalization of $350,000,000. Dun and Bradstreet weekly reports of bank, trust company and commercial failures very rarely include an independent telephone company. Losses occur in every branch of business—there is no industry which can boast of absolute safety against reverses. Capital seeking investment with a view of increasing intrinsic as well as market values, earnings and dividends, stability and permanence, must not overlook independent telephone securities. A careful investigation will place the stocks and bonds of well-managed companies among the list of high-class securities."

American Society of Mechanical Engineers.

The spring meeting of the American Society of Mechanical Engineers was held at Indianapolis, Ind., May 28-31 inclusive. On May 30 the society attended, in a body, the ceremonies in connection with the unveiling of a bronze statue of General Lawton at the court-house, and listened to President Roosevelt's address. On May 31 a trolley excursion was taken to Purdue University, Lafayette, in the morning, and the concluding session was held there. The sessions at Indianapolis were held in the palm room of the Claypool Hotel, where the society had its headquarters.

The Machine Screw Committee presented a final report, which was accepted. This completes four years' work. The screw recommended has a sixty-degree thread, with widths of flat between one-eighth and one-sixteenth of the pitch. This allows for greater variation and clearance than was provided in the first report.

The Committee on a Code of Rules for Conducting Tests of Refrigerating Machines presented a second report. This does not complete the work of the committee, but contains a provisional code for conducting such tests.

Professor R. T. Stewart presented a second paper on "The Strength of Lap-Welded Steel Tubes Subjected to External Pressure." His first paper was presented at the Chattanooga meeting last year. It had been found later that many of the tubes tested were not greatly deformed, and could be retested. This was done, sometimes one tube submitting to eleven successive tests. The results show the strength of the tubes when they have different degrees of out-of-roundness, and indicate that while there is considerable loss of strength on this account, when it is not very apparent to the eye, it is amply provided for by the ordinary factors of safety.

In a paper entitled "Balancing of Pumping Engines," A. F. Nagle recommended that the weight of plungers and reciprocating parts in single-acting plunger-pumping engines be proportioned so as to equalize the work on the up and down strokes.

E. C. Soper read a paper entitled "The Economy of the Long Kiln," which dealt with rotary cement kilns fired with natural gas.

Henry Hess, of Philadelphia, Pa., presented a long paper on "Ball Bearings," which contained a translation of a paper on this subject, written by R. Stribeck, of Berlin, and a discussion of proper methods of mounting when utilizing such bearings.

H. O. Lacount, in a paper on "The Cost of Heating Storehouses," described a study of a number of factory storehouses, in order to determine the average winter temperatures and means for preventing freezing of the automatic sprinkler systems. He finds that the cost of heating will be, in general, a little greater than the cost of dry pipe attachments. He suggests that a sprinkler system might be filled with a solution of calcium chloride, which would insure it against freezing if

the temperature did not fall lower than thirty degrees below zero.

A paper on "Analysis of Locomotive Tests," by S. A. Reeve, discussed, in some detail, the tests made by the Pennsylvania Railroad's testing plant at the St. Louis Exposition. B. D. Gray contributed a descriptive paper entitled "European Railway Motor Cars."

There were nine papers dealing with superheated steam. One by H. H. Vaughan, entitled "Superheated Steam on Locomotives in the United States and Canada," described the superheater used on 300 engines of the Canadian Pacific Railway. W. F. M. Goss described the Cole locomotive superheater. A. R. Dodge, in a paper entitled "The Specific Heat of Superheated Steam," described the elaborate tests which had been made at Schenectady for the General Electric Company during the last five years. E. F. Foster presented a paper entitled "The Flow of Superheated Steam Through Pipes." He believes that the percentage loss in heat decreases with the velocity with which the steam flows through the pipes, and recommends that they be proportioned for a velocity of from 6,000 to 8,000 feet per minute when the superheat is from 100 to 200 degrees Fahrenheit. R. P. Bolton read a paper entitled "Superheat and Furnace Relations," and S. L. Kneass one on "The Use of Superheated Steam in Injectors," showing the desirability of operating injectors by means of saturated steam. G. H. Barrus presented a paper entitled "Experiences with Superheated Steam," and embodied in this the results from nine plants where superheated steam is being used. A paper entitled "Materials for the Control of Superheated Steam" was read by M. W. Kellogg. Among other suggestions, the author advises against the use of screw pipe joints for superheated steam. The result of these papers was the decision to appoint a committee to report upon the flow of superheated steam, if this action meets with the approval of the council.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

ANNOUNCEMENT OF THE TWENTY-FOURTH ANNUAL CONVENTION, NIAGARA FALLS, N. Y., JUNE 25 TO 29.

The twenty-fourth annual convention of the American Institute of Electrical Engineers will be held at Niagara Falls, N. Y., June 25 to 29. Headquarters and sessions will be held at the Cataract Hotel. The following programme has been announced:

TUESDAY, JUNE 25—MORNING SESSION—9.45 A. M. TO 12.30 P. M.

Address of welcome.

President's Address—"The Properties of Electrons," by Samuel Sheldon.

"Protective Apparatus Engineering," by E. E. F. Creighton.

"Practical Testing of Commercial Lightning Arresters," by Percy H. Thomas.

"A Proposed Lightning-Arrester Test," by N. J. Neall.

EVENING SESSION—8 TO 10.30 P. M.

"Interaction of Synchronous Machines," by Morgan Brooks.

"The Heating of Copper Wires by Electric Currents," by A. E. Kennelly.

"Deflocculated Graphite," by E. G. Acheson.

WEDNESDAY, JUNE 26—MORNING SESSION—9.45 A. M. TO 12.30 P. M.—HIGH-TENSION TRANSMISSION COMMITTEE.

"Choke-Coils *versus* Extra Insulation on the End-Windings of Transformers," by S. M. Kintner.

"Protection of the Internal Insulation of a Static Transformer Against High-Frequency Strains," by Walter S. Moody.

"Transmission-Line Towers and Economical Spans," by D. R. Scholes.

"Lightning Rods and Grounded Cables as a Means of Protecting Transmission Lines Against Lightning," by Norman S. Rowe.

"The Transmission Plant of the Niagara, Lockport & Ontario Power Company," by Ralph D. Mershon.

"Location of Broken Insulators and Other Transmission-Line Troubles," by L. C. Nicholson.

"A New Type of Insulator for High-Tension Transmission Lines," by E. M. Hewlett.

"Some New Methods in High-Tension Line Construction," by Harold W. Buck.

EVENING SESSION—8 TO 10.30 P. M.

"Switchboard Practice for Voltages of 60,000 and Upward," by S. Q. Hayes.

"Some Power-Transmission Economics," by F. G. Baum.

"One-Phase High-Tension Power Transmission," by E. J. Young.

"The Application of Oil Switches in Power-Transmission Work," by D. B. Rushmore.

THURSDAY, JUNE 27—MORNING SESSION—9.45 A. M. TO 12.30 P. M.

Topical discussions:

"Single-Phase *versus* Three-Phase Generation for Single-Phase Railways," by A. H. Armstrong.

"The Choice of Frequency for Single-Phase Alternating-Current Motors," by A. H. Armstrong.

"Twenty-five *versus* Fifteen Cycles for Heavy Railway Service," by N. W. Storer.

AFTERNOON SESSION—2.30 TO 5 P. M.

Report of the Committee on a Code of Ethics.

"The Attitude of the Technical Schools Toward the Profession of Electrical Engineering," by H. H. Norris.

"The Concentric Method of Teaching Electrical Engineering," by Vladimir Karapetoff.

Standardization Rules—The proposed revision of the standardization rules will be reported by the standardization committee.

FRIDAY, JUNE 28—MORNING SESSION—10 A. M. TO 12.30 P. M.

"Track-Circuit Signaling on Electrified Roads," by L. F. Howard.

"Regeneration of Power with Single-Phase Electric Railway Motors," by William Cooper.

"Notes on Transformer Testing," by H. W. Tobey.

"Inductive Disturbances in Telephone Lines," by Louis Cohen.

AFTERNOON SESSION—2.30 TO 5 P. M.

"Fractional Pitch Windings for Induction Motors and Alternators," by C. A. Adams, W. K. Cabot and G. Æ. Irving, Jr.

"Power-Factor, Alternating-Current Inductive Capacity, Chemical and Other Tests of Rubber-Covered Wires of Different Manufacturers," by Henry W. Fisher.

"The Vector Diagram of the Compensated Single-Phase Alternating-Current Motor," by W. I. Slichter.

"Zigzag Leakage of Induction Motors," by R. E. Hellmund.

ENTERTAINMENT.

The local committee has arranged the following events:

Tuesday afternoon, June 25—Trolley trip through Niagara Gorge; tickets cost about one dollar for each person.

Wednesday afternoon, June 26—Afternoon tea at Natural Food Company's conservatory, 4 to 6 P. M.

Thursday morning, June 27—Automobile trip for the visiting ladies.

Thursday evening, June 27—Reception, Cataract Hotel, 9 P. M.

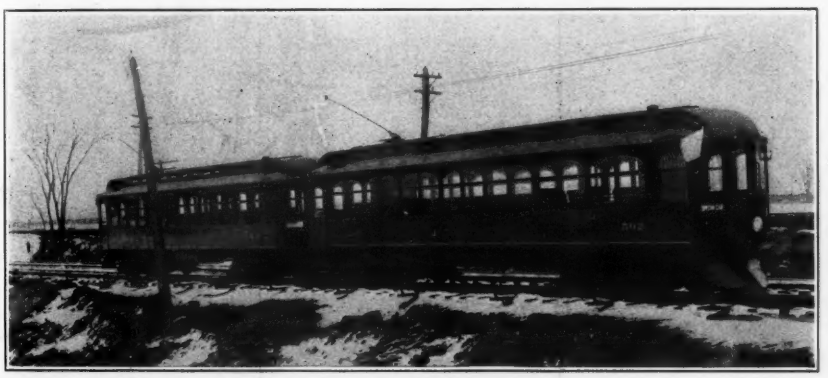
The concession of one-third fare for the return trip on the certificate plan which has been obtained in previous years for members and guests attending the convention has been granted by only three of the passenger associations this year, *viz.*, New England, Trunk Line, and Eastern Canadian passenger associations.

The Electrification of the West Shore Railroad between Utica and Syracuse.

THE official opening of the electrified section of the West Shore Railroad between Utica, N. Y., and Syracuse, N. Y., took place on June 15. The work of electrification has been carried out by the Oneida Railway Company, a corporation identified with the so-called Andrews-Stanley syndicate, which syndicate, in conjunction with the Vanderbilt New York Central interests, owns several electric traction properties in New York state, including the Utica & Mohawk Valley Railway, the Syracuse Rapid Transit Company, the Rochester Railway and Light Company and the Rochester & Eastern Rapid Railway, and also in conjunction with the Delaware & Hudson Railroad Company, the traction systems in the cities of Schenectady and Albany.

The Oneida Railway Company entered into a contract with the New York Central company under which the former agreed to lease the tracks of the West Shore Railroad between Utica and Syracuse, equip them for electric operation and conduct the passenger business between these two points. The New York Central on its part consented to abandon the West Shore local trains on these tracks, but reserved the right to continue its through steam trains and to haul freight over the electrified section by steam locomotives. The main tracks of the New York Central Railroad depart from the direct line between Utica and Syracuse and sweep by a long curve to the north through Rome. The electrified section of the West Shore retains the general easterly and westerly direction by a route seven miles shorter than that of the New York Central and extending through a well-populated and rich territory. Among the towns traversed are Oneida, 9,000 population; Vernon, 3,000 population, and Canastota, 5,000 population. The distance between the two cities is a little over forty-four miles, but under the West Shore schedule extremely scanty passenger transportation facilities were provided. With the exception of two trains with sleepers passing over the line at night, and of practically no use to the contiguous or terminal population in Utica and Syracuse, there were only two trains each way a day. Here, then, was the logical place to apply electricity.

It is proposed to give three classes of service over the West Shore tracks between Syracuse and Utica. First, there will be the fast limited electric cars or trains which will run hourly between the two cities and will make two stops only, completing the run in one hour and twenty-eight minutes. Twenty-eight minutes of this time will be taken on the local system at each end, and one hour for the run between the two cities. Second, there will be the local trains or cars, which are scheduled to make twenty-four miles per hour, and which will complete the run in one hour and fifty-eight minutes. This service will be run hourly and the cars will make frequent stops, at every highway if necessary. Third, there will be the steam service. To provide for passing the fast-moving units around the slower trains, a third track has been laid between Clark's Mills and Vernon, a distance of eight and one-half miles. This middle track has cross-over connections with both outside tracks and will be used jointly by both eastbound and westbound traffic to expedite the movement of all trains. It will be under the control of switchmen located in interlocking switch towers to insure safety and despatch in the handling of train movements under all conditions. In addition, between Oneida and Canastota, a distance of about five and one-half miles, a fourth track has been laid, as there are water stations and freight yards in this section and it is necessary to provide four tracks to pass the electric units around the freight trains that may be held up in the yards or at watering stations. The outside tracks will be used for the local trains.



MULTIPLE-UNIT TRAIN OPERATED BY THE ONEIDA ELECTRIC RAILWAY OVER THE ELECTRIFIED SECTION OF THE WEST SHORE RAILROAD BETWEEN UTICA, N. Y., AND SYRACUSE, N. Y.

Power for the operation of the line is purchased from the Hudson River Electric Power Company, which owns the hydraulic power plants at Spiers Falls and Mechanicsville. This company is now extending its transmission line from its water-power plants to Utica, and expects soon to be able to deliver electric power to those points at 60,000 volts.

Pending the completion of these transmission lines, and to fulfil contracts which it had taken for power in the district around Utica, the Hudson River Electric Power Company has recently erected a temporary steam plant in that city. This station is equipped with steam turbines and is delivering power to the Oneida Railway Company at 60,000 volts, three-phase, and forty cycles for its West Shore work. The contract of the power company provides that it shall deliver this power to the transmission circuit of the railway company, which commences at the Clark's Mills substation, which is that nearest Utica. The power company's transmission line for this distance of four and one-half miles is constructed on a private right of way adjoining the West Shore tracks, and is carried on two-circuit steel towers, spaced approximately 550 feet apart. At Clark's Mills the current is taken by the Oneida Railway Company and is conducted to the three other substations over its own transmission line, which is also built on the private right of way of the West Shore Railroad. For serving the entire section between Utica and Syracuse, about forty-four miles, there are four substations, as follows: No. 1, at Clark's Mills; No. 2, located one and one-half miles west of Vernon; No. 3, located one mile west of Canastota, and No. 4, located at Manlius Center. The distance between the substations averages approximately ten and three-quarters miles. The transmission line is continuous; that is to say, it is carried into each

substation and is there tapped to the bus-bar through disconnecting switches, then passes to the next substation.

The transmission towers used on the Oneida company's transmission line differ from those employed on the power company's line. They consist essentially of a square latticed structure composed of four angles, three by three by five-sixteenths inches, carried down five feet to reinforced concrete footings under each pier, measuring five feet by three feet by ten inches. The distance between towers is 480 feet. These towers are figured for a side pressure of the wind of one and one-quarter pounds per lineal foot of cable, which is based on a wind pressure of thirty pounds per foot on a flat surface, of fifteen pounds per foot on a round surface, acting upon the cable covered with a thickness of sleet equal to its own diameter. The maximum pull allowable on a single cross-arm tower is 1,000 pounds for each cable, the ties being designed to break at this tension. The cross-arms of towers at dead ends carry three insulators for each cable and are designed to resist the maximum calculated pull due to the assumed conditions of load and sag.

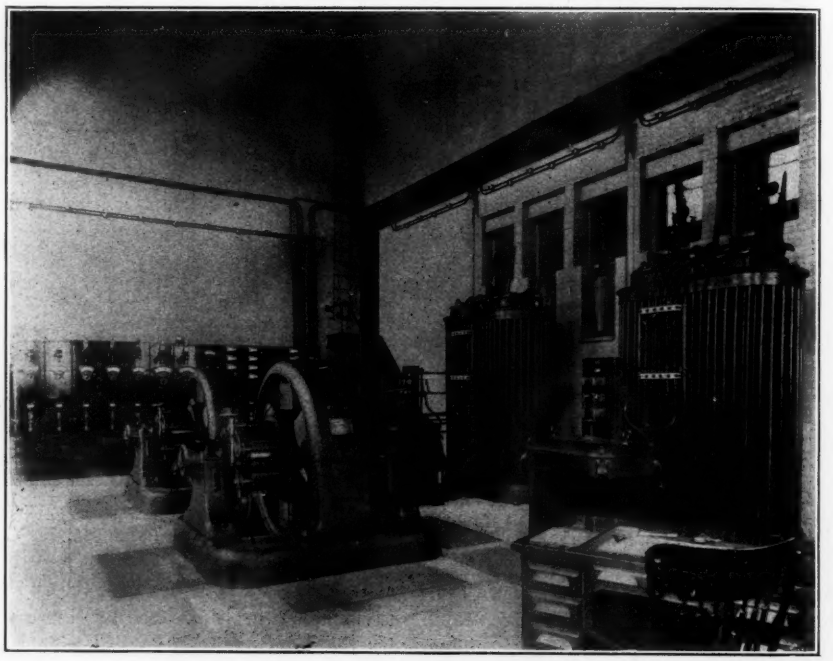
The heights of the towers are arranged to provide a minimum clearance of ten feet over buildings and over such wires as may be crossed by the line. At points where the transmission line makes an angle the towers are provided with enough insulators so that the cables do not make an angle of over seven and one-half degrees at any insulator.

The insulators are of porcelain, were supplied by R. Thomas Sons & Company, of Lisbon, Ohio, and are placed at the corners of a seven-foot triangle. They are carried on malleable-iron pins eighteen inches high, which are designed to withstand a strain of 2,000 pounds applied in any direction at the top of the insulator. These pins are attached to the apex of the tower or the cross-arm with four five-eighths-inch bolts and are cemented into the insulators at the factory.

A No. 0, seven-strand, hard-drawn copper cable is used for each conductor. This cable is strung on the towers with a sag of twelve feet for a 480-foot span, at thirty-two degrees Fahrenheit. This sag corresponds to a normal tension of 300 pounds in the cable. Where the span varies from this length the sag is shortened or lengthened so as to keep the tension in the cable practically constant. Where heavy strains occur, necessitating a double cross-arm, the cable, instead of resting on insulators, is attached to an equalizing saddle to distribute the load equally over several insulators. These saddles are so designed that in case one insulator should be defective it may be removed and another substituted without removing the cable from the saddle. The use of lightning arresters is confined to the substations themselves.

The four substations previously mentioned are of similar design. They are of brick with litholite trimmings, concrete roof and concrete floors. They are divided into two main compartments, at the rear the high-tension room and in front the converter room.

This being one of the first 60,000-volt installations in this section of the country, extreme care has been taken to give the necessary clearances on the high-tension side. The layout in general is a typical General Electric layout, the high-tension line entering the under side of a protecting hood at the rear of the building and thence passing through circular openings three feet in diameter in the wall of the building to the disconnecting switches and onto the bus compartments.



One of the Oneida Railway Company's Substations.

The high-tension room is two stories in height, the floor being carried only to the face of the barrier walls, which run three feet apart and three feet in depth, up and down the rear wall. This provides a number of cells or compartments open from top to bottom, which are used for the installation of the lightning arresters and bus-bars. The second floor, extending through the room, permits an operator to handle the disconnecting switches, which are located at the top of these compartments. Against the forward wall on the second floor of this high-tension room are built similar barriers forming cells in which are installed the high-tension oil switches. Three of these cells are required for each switch, one leg being in each. These switches are General Electric type H, motor-operated, the mechanism being placed at the top of the barrier. There are three of these in each station except the last, one controlling each of the two machines and one the outgoing high-tension line. These switches are operated from the switchboard in the converter room. On the first floor of this high-tension room and immediately under the oil-switch compartment, and running transversely through these barrier walls supporting the oil switches, there are three compartments, three feet square, one above the other, and extending the length of the room. These are the bus compartments proper and carry the high-tension line through the station. It is from these busses that taps are made and carried up to the oil switches. This room is separated from the converter room by fire doors, and the second floor is reached by an iron stairway.

In the converter room are the transformers, rotaries and switchboard. Each transformer stands in front of its respective oil switch, and the connections from each pass through openings three feet

square in the brick wall in which is inserted a pane of glass with a suitable hole for the passage of the wire. All of the high-tension wires, as far as the transformer terminals, are of bare copper wire. In recesses provided for the purpose under the openings in the wall where the high-tension line passes through to the transformers are located the current transformers. In the converter room are two units consisting of one 330-kilowatt, 60,000-370-volt, oil-cooled transformer, Y-connected on the primary side and delta-connected on the secondary side, and one 300-kilowatt, 370-volt alternating-current and 600-volt direct-current rotary converter. Between the transformer and the rotary stands the reactance which is used for starting the rotary converters. This is the General Electric Company's latest method of starting rotary converters without synchronizing.

The switchboard consists of the necessary alternating-current and direct-current rotary converter panels, an outgoing high-tension line panel containing ammeters and voltmeter, storage-battery panel and the necessary direct-current feeder panels.

The direct-current feeder panels are connected to the third rail at the station by means of rubber and lead-covered cable, each track being independently fed each way from the substation; that is, on a two-track section there would be four feeder panels. Auxiliary feeders will not be necessary for the service contemplated. A storage battery is located in the subway and is used in operating the oil switches.

The converter room is provided with a heater system, which is located in the west end of the building in an entirely separate room along with the toilet, lavatory conveniences and storage room for supplies. The building is of fireproof construction throughout.

The third rail is of the bull-headed or double-headed type, of the same section as that adopted in the New York city zone of the New York Central Railroad, and is adapted for under-running contact. It weighs seventy pounds per yard and was supplied in thirty-three-feet lengths by the Lackawanna Steel Company, but as the density of traffic did not require unusual electrical conductivity, a special composition to secure low resistance was not used, as in the New York Central work. The composition is, in fact, that used in the standard seventy to eighty-pound rails rolled by the Lackawanna Steel Company, and consists of carbon, 0.45 to 0.55; phosphorous, not over 0.10; silicon, not over 0.20, and manganese, not over 0.75 to 1.05. This gives a resistance of 0.0494 ohms per mile; in other words, the conductivity of the rail is equivalent to 1,023,000 circular mils of copper. This conductivity is sufficiently large so that no auxiliary direct-current feeders are required.

THREE-TRACK THIRD-RAIL CONSTRUCTION AND TRANSMISSION LINE, ELECTRIFIED SECTION, WEST SHORE RAILROAD, BETWEEN UTICA, N. Y. AND SYRACUSE, N. Y.

The joints in the third rail are made by ordinary two-bolt splice bars with bolts seven-eighths inch in diameter. The centre line of the rail is carried thirty-two inches outside of the gauge line of the track and its lower surface is two and three-quarters inches above the top of the running rail.

The Long Island Railroad dimensions have also been employed on the West Jersey & Sea Shore Railway. The clearance on the West Shore differs from that of either of the others mentioned, but was adopted after a study of the traffic passing over the road. It will permit the passage of all the cars belonging to the New York Central system, and all foreign cars, except a very limited type of coal cars with low truss rods. Electric locomotives and motor-cars designed for use on the Central tracks can also be run over the West Shore tracks without changing the position of the third-rail shoe.

The third rail is normally located between the tracks on tangents and on the high side of the track on curves.

The brackets for supporting the third rail on the straight track are located ten feet apart, or on every fifth tie.

The insulators used for holding the third rail in the brackets were supplied by the Ohio Brass Company and are of semi-porcelain. Two sizes are used, one for holding the rail at the inclines, where a shallower insulating block is required, the other for supporting the rail at other points.

In laying the third rail a space of about one-quarter inch is left at each joint for expansion and contraction.

Two types of protective covering are used, as on the New York Central, *viz.*, a three-part wooden covering which was originally adopted, and a single-piece fibre covering which was manufactured by the Indurated Fibre Company, Lockport, N. Y., and is considered preferable.

The majority of the bonds on the third rail are the John A. Roebling's Sons Company's ribbon bond. These bonds are fifteen inches in length over all and are soldered to the rail, one on each side of the upper head, and have a very large contact surface per terminal. There have also been installed on a portion of this line about 3,000 Ohio Brass Company's ribbon soldered bonds and about 7,000 American Steel and Wire Company's twin terminal bonds. These bonds are of 500,000 circular mils capacity each, and are installed two per joint on the upper head of the third rail. The wood cover is cut away at all joints, so as to allow the cover to go over the bond. The fibre cover has an enlarged section at these joints, which allows for completely covering the bond.

The running rail is bonded with the Ohio Brass Company's eleven-inch compressed terminal bond, placed under the

fish plate. There is one of these at each joint, and each bond is of No. 0000 capacity. The track is cross-bonded only at special work. Both rails are available for use for the return circuit.

The connection between the direct-current bus-bars in the various substations and the third-rail system is made through several cables of 1,000,000 circular mils capacity, carried in iron ducts, three inches in diameter.

The third-rail jumpers used to secure continuous electrical connection between the sections of the third rail are of 1,000,000 circular mils capacity.

At the substation end, the connections to the east and westbound tracks are carried to separate panels on the switchboard, so that electrically the east and westbound tracks are kept entirely distinct except through the bus-bars. In this way an interruption on one track has no effect on the other. The panels in each substation connecting with each track, however, are in parallel, and no section switches are used. In one or two instances, where there are long sidings equipped with the third rail, as at Clark's Mills, an extra panel has been added to the switchboard to supply the current for this section.

As the cars are to operate over the city system in both Utica and Syracuse, a different type was adopted than if they were to use the West Shore tracks exclusively. The cars are forty feet long over the end panels, the interiors are of inlaid mahogany, which includes the doors; the ceilings are full Empire decorated, the floor is covered with interlocking elastic tile, and a rubber mat is furnished for each vestibule. Storm sashes are furnished for the side windows, which replace window guards in winter. The cars are equipped with twenty-four reversible and two stationary plush seats with high backs and head rolls. Each car is also fitted with a toilet lined with "Mettile."

The truck used is the Brill No. 27 E-2, with a wheel base of six feet six inches. The wheel diameter is thirty-seven inches, the axle diameter five and one-half inches and six inches. The wheel tread is four inches wide and the depth of the flange is one inch, to allow the cars to operate over the city systems in Utica and Syracuse.

Each car is equipped with four G. E. 73 motors with Sprague-General Electric multiple-unit control. Westinghouse automatic air-brakes with graduated release and Peter Smith hot-water heaters are used.

The installation of the electrical equipment of the line has been conducted by the engineering force of the Oneida Railway Company, of which C. Loomis Allen is vice-president and general manager, W. J. Harvie is electrical engineer and M. J. French, Jr., is engineer of maintenance of way.

An Alternating-Current Coal-Mining Installation.

After operating an electric haulage system at the Kilsyth mine for some years, the company which owns this property and also controls a number of other mines in the New river field of West Virginia, decided to extend its electrical system for doing the work at the other shafts. The old plant was not centrally located, but a central site, while available, was not suitable, because of a lack of water. It was therefore decided to install an alternating-current system at fairly high voltage on the old site, and transmit power from here to substations at the points of utilization. The system as installed is described in the *Engineering and Mining Journal* by T. W. Sprague and C. K. Stearns. One unit has been installed, rated at 500 kilowatts, although provision has been made for a second. There are four horizontal tubular boilers furnishing steam to a Corliss engine which is direct-connected to the generator. The latter generates current at twenty-four cycles, 6,600 volts, three-phase. It is a Bullock machine having a revolving field with twenty-four poles. The excitation current is supplied from a twenty-kilowatt generator driven by a high-speed engine. The alternator is controlled from the switchboard by means of electrically operated oil switches placed in the rear of the board. From this station the lines are carried on wooden poles by means of porcelain insulators supported by iron pins. The first substation is at Oswald, about two and one-half miles from the central station. Here there is a 300-kilowatt rotary converter with the equivalent transformers, which furnishes current at 275 volts for the mine railway. The second substation is at Graham, about a mile and a half beyond Oswald. Here there is a 200-kilowatt rotary with transformers, furnishing current to the Graham pit. Near the Oswald substation there is a fan for the Sydney mines. Here there is an eighty-horse-power, three-phase induction motor driving a fan eleven feet in diameter, and four feet four inches in width. This runs at 230 revolutions, and can deliver 100,000 cubic feet of air per minute against a three-inch water-gauge pressure. The fan normally draws air from the mine, but by means of gates, can be used to force the air into it. About a half-mile beyond this fan is a second fan for supplying air to the Oswald mine, and near the Graham substation is a third fan house, in which there is a nine-foot fan driven by a forty-horse-power motor, capable of delivering 75,000 cubic feet of air per minute against a two-inch gauge pressure. These fans are started by means of autotransformers and a double-throw switch. Each motor is provided with large and small pulleys, and drives the fans by means of belts, so that there are two speeds obtainable. The motors operate at 440 volts, three transformers being provided with each. A bank of lamps is connected across the low-voltage mains and kept lighted as a means of indicating when current is on the line.

The New York City Telephone Situation.

W. B. Ellison, corporation counsel for the city of New York, has handed down an opinion concerning the right of the city to effect a non-competitive agreement with a telephone company for furnishing telephone service in the city.

The Atlantic Telephone Company in its effort to get a footing in New York has offered attractive terms to the municipality for a franchise, but these offers have been met with a counter proposal from the New York Telephone Company that it would be willing to comply with any reasonable demands in the way of compensation and requirements made by the city providing no franchise was granted to any other company. As most of the members of the Board of Estimate are of the opinion that a dual telephone system would not work well, Corporation Counsel Ellison was asked some time ago for an opinion as to whether the municipal government could make an agreement on the lines suggested.

The effect of Mr. Ellison's opinion was that while the city could not grant a monopoly to any one company, it undoubtedly had the right, in the interests of public convenience, to make an equitable agreement with the New York Telephone Company, but the making of such a contract would not prevent the city granting other franchises if changed conditions should warrant a duplicate telephone service. After reviewing the general situation, Mr. Ellison wrote:

"I therefore advise you that if in the wisdom of your board but one system of telephone service is advisable or proper under conditions presently existing, an application for the right to supply such service may be considered and granted on satisfactory terms, the payments provided thereby to continue only so long as the grantee company enjoys the sole privilege of supplying such service, provisions being made for a reduction or modification of such terms in the event of other telephone systems being established in the city or other telephone franchises being granted. It should clearly appear that such a grant should not be a bar to the city making other grants under changed conditions, or even if the city should thereafter conclude to grant other applications for similar service.

The Forty-first Annual Convention of the Master Car Builders' Association.

The forty-first annual convention of the Master Car Builders' Association was held at Atlantic City, N. J., June 17, 18 and 19. The proceedings included reports of the standing committees and the reading of practical papers. The American Railway Master Mechanics' Association also met at Atlantic City on June 12, 13 and 14. A feature of this gathering was the exhibit of railway appliances, prominence being given to a display of heavy electric railway material. Among those exhibiting were the following:

The Consolidated Car Heating Company, New York city, exhibited the McElroy automatic car-lighting system, showing an axle-driven generator and automatic regulator. The company's cross-seat, truss-plank and panel types of electric heaters, and a new automatic cab-heater switch and special switchboards were also shown. A new steam coupler with sliding gasket and automatic lock, and a hot-water drum system, standard direct steam-heating system, and low-pressure steam-heating system were demonstrated. The company was represented by Cornell S. Hawley, general sales agent; Francis C. Green, general manager; W. S. Hammond, Jr., western district manager; T. M. May, New York office, and S. Butler Keyes, eastern district manager.

The Crocker-Wheeler Company, Ampere, N. J., exhibited a variable-speed form I-F motor and photographs showing typical installations of its various apparatus. The company was represented by Rodman Gilder, R. J. Randolph, Jr., L. S. Horner, H. L. Patteson, A. L. Doremus, H. L. Sage and F. B. DeGress.

The General Electric Company, Schenectady, N. Y., fitted up a very comfortable reception headquarters, although no set exhibit was made. The company was represented by W. B. Potter, engineer railway department; W. J. Clark, manager traction department; L. R. Pomeroy, R. E. Moore, C. C. Pierce, E. D. Priest, J. J. Mahony, J. O. Barry, A. W. Jones and F. H. Gale.

The Independent Pneumatic Tool Company, Chicago, Ill., showed the "Thor" pneumatic tools and appliances. The company was represented by W. O. Jacquette, R. T. Scott, J. H. Davis, F. A. Berbey, James B. Brady, J. A. Porter, A. B. Holmes, J. P. Bourge, C. Mathie, H. H. Hale, Charles Parsons, A. Gallinger, R. D. Hurley and J. D. Hurley.

The H. W. Johns-Manville Company, New York city, exhibited its asbestos fireproof coverings, packings and flange material. The company also showed a line of insulating material, "Noarc" fuses, fire extinguishers, the "Perolin" dustless sweeping compound, and samples of its sectional conduit for underground steam-heating systems. The company was represented by F. G. Corbin, H. O. Fettinger, W. F. Taylor, J. W. Allan, C. E. Murphy, J. C. Younglove, John H. Trent, E. C. Sawyer and F. M. Gilmore.

The George W. Lord Company, Philadelphia, Pa., exhibited samples of Lord's boiler compounds.

The National Brake and Electric Company, Milwaukee, Wis., exhibited the new type of National air-brake apparatus. The company was represented by R. P. Tell, J. T. Cunningham, W. H. Goble, S. I. Wailes, E. Aikman and C. N. Leet.

The Ohio Brass Company, Mansfield, Ohio, exhibited a line of railway material, including car-signaling systems, automatic car couplers, sand valves, draft rigging and draw-bar gear. The company was represented by Nathan Shute, R. M. Campbell, F. A. Strail and J. S. Hamlin.

The Sprague Electric Company, New York city, exhibited its flexible steel-armored hose. The company was represented by Allan C. Bakewell, president; A. E. Braddell, W. A. Treat and E. E. Ruete.

The Westinghouse Companies included exhibits from the Westinghouse Air-Brake Company, the American Brake Company, the Westinghouse Machine Company, the Westinghouse Electric and Manufacturing Company, the Westinghouse Automatic Air and Steam Coupling Company, the Nernst Lamp Company and the Cooper Hewitt Electric Company. The exhibit included friction draft gear, air-pumps, automatic air and steam couplers, the Westinghouse storage battery, variable-speed direct-current motors and switchboards, arc lamps, incandescent lamps, Nernst lamps and Cooper Hewitt mercury vapor lamps. The companies were represented as follows: Westinghouse Electric and Manufacturing Company—E. M. Herr, J. H. Klinck, R. F. Moon, John R. Warden, C. F. Street, D. B. Pendleton, A. T. Chamberlain, Charles Robbins and Charles Talbot; Westinghouse Air-Brake Company—A. L. Humphreys, S. C. McConahey, W. B. Turner, Joseph R. Ellicott, F. M. Nellis, S. D. Hutchins, Fred Green, John F. Miller, Arthur Johnson, W. S. Bartholomew, A. E. Craig, C. P. Cass, C. C. Farmer, J. P. Kelley, T. L. Burton, S. J. Kidder, Charles Ellicott and P. S. Clark; American Brake Company—F. B. Schwentler, E. L. Adreon and C. C. Higham; Westinghouse Automatic Air and Steam Coupling Company—R. E. Adreon and N. F. Niederlander; Nernst Lamp Company—John Gossler; Cooper Hewitt Electric Company—Eugene Hayes. J. C. McQuiston, manager of the Westinghouse Companies publishing department, was in charge of the exhibit.

The Yale & Towne Manufacturing Company, New York city, exhibited duplex and triplex portable electric hoists. The company was represented by C. W. Beaver, William Hazelton, E. J. Ford, R. T. Hodgkins, F. A. Hall and H. E. Dickerman.

New York Board of Estimate Recommends the Granting of a Franchise to the Atlantic Telephone Company.

On June 14 the board of estimate of the city of New York adopted a resolution recommending the granting of a franchise which has been applied for by the Atlantic Telephone Company. This action is nothing more than a suggestion that the board of estimate take up the application at an early meeting, and if it is then decided to grant the franchise, the terms and conditions will be determined.

A Correction.

In the issue of the ELECTRICAL REVIEW for June 8, on page 926, in reporting the representatives in attendance at the thirtieth convention of the National Electric Light Association, it was stated that Alexander Henderson represented the Sprague Electric Company. Mr. Henderson has no connection with the Sprague Electric Company, and has represented the American Circular Loom Company for the past year and a half.

Death of W. E. L. Gaine.

Mr. William Edward Louis Gaine, general solicitor and manager of the National Telephone Company, of Great Britain, died in London, England, on June 18. Mr. Gaine was born in London in 1851. In 1875, at the age of twenty-three, he was appointed town clerk of the county borough of Blackburn, Lancashire. He later became connected with the National Telephone Company, and in 1892 the position of general manager of the company was offered to him. Soon after this appointment, the National Company acquired those telephone companies which were operating in Great Britain outside of its jurisdiction, and the result of this amalgamation covered the whole of the country. Under Mr. Gaine's organization and administration the company has grown steadily. Mr. Gaine was a member of the Incorporated Law Society and the Institution of Electrical Engineers, of Great Britain.

Specifications for Street Lighting.

At the Washington convention of the National Electric Light Association, June 4-7, the report of the committee to consider specifications for street lighting was presented, and after some discussion, it was decided that the committee complete its report by appending a table showing the ratings of the different lamps and issue it, with the approval of the executive committee, to the members of the association. An abstract of this report, which was one of the most important considered during the convention, is given below, together with an explanation of its features by Dr. C. P. Steinmetz. The committee consisted of Dudley Farrand, chairman, A. E. Kennelly, Charles P. Steinmetz, Louis A. Ferguson and Paul Spencer.

In the year 1894 a committee of experts was appointed by the association to consider the rating of arc lamps and reported at the seventeenth convention, then in session at Washington, a preamble and resolution which was adopted as follows:

Recognizing the difficulty, if not impossibility, of measuring with any degree of accuracy the illuminating power of the arc lamp, and the great necessity for a more precise definition and statement of the obligations of the producer of electricity for illuminating purposes to the consumer thereof, be it

Resolved, That in the opinion of this convention what is ordinarily known as a 2,000-candle-power arc lamp is one requiring on the average 450 watts for its maintenance, the measurements being made at the lamp terminals, where no sensible resistance is included in series with the arc. In case such resistance is used, it must be excluded in the measurement of the voltage.

The rating of arc lamps on the basis of energy consumed, as set forth in the resolution, was then and would now be satisfactory as an equitable means of determining either a proper rate of charge or illuminating value for street arc lighting furnished by a company to a municipality, under the same conditions, but at the time of the adoption of this resolution there was in use in the United States no type of arc lamp other than the open arc, which, although of many makes and designs, gave approximately the same illuminating power for a given amount of energy. Wherever the rating adopted by the committee in 1894 has been employed in connection with open-arc lamps of the general type then in use, little or no difficulty has been experienced in the adjustment of differences arising from interpretations of contracts.

During the very year in which this rating was adopted, however, the commercial introduction of enclosed-arc lamps began, and within the past ten or twelve years the gradual displacement of open-arc by enclosed-arc lamps has taken place. During the past four or five years there have been placed upon the market a number of distinct new types of lamps, which have been known by the general designation of "flaming carbon" or "luminous arc" lamps, some of which originated from American ideas, while others were imported.

In addition to the new types of arc lamps, there have also been placed on the market and are now offered for sale certain kinds of mercury-vapor or vacuum-tube lamps, which can be used for street lighting, as well as a considerable number of new incandescent lamps constructed of some form of metallized filament. Quite a number of the latter are already in use, with every prospect of their general introduction within a reasonable time.

Any attempt to compare the illuminating value of these latest forms of lamps, which are or may be used for street lighting, on the basis of energy consumed, is not only futile, but would be ruinous to the contracting company, for while the so-called high-efficiency lamps operate on a lesser expenditure of energy, they also give a larger volume of light.

The committee, after a most careful consideration of the difficulties to be met, and for the purpose of establishing a definite basis, assumed: That, inasmuch as the lighting of streets by contract is a matter of illumination produced rather than of apparatus employed, the terms used in specifications should be in terms of illumination and not of energy consumed; that the individual lamp of each class should be the unit of number charged for; and that the average illuminating power of each unit should be comparable with and have a value equal to a known standard at proper relative distance.

The following report is submitted as the best provisional solution of the problem of street lamp specification that the unsatisfactory existing state of the science and art of outdoor photometery permits.

The committee considers that street-lighting lamps should not be rated in candle-power under contract specifications; because unless qualified as to the space distribution of the candle-power, such rating may be entirely misleading. The lamp may, by suitable reflectors, be made to possess a large candle-power in some particular direction or zone, and yet be very ineffective as a practical street illuminant. Consequently, the committee considers that the rating of street lamps in contract specifications should be in terms of the mean normal illumination cast at a considerable distance from the lamp, along the street which it illumines, *i. e.,* the mean illumination thrown by the lamp upon a plane surface at a considerable distance from the lamp and supported perpendicularly to the rays.

The following specifications are drawn to cover the ordinary conditions of street lighting, and are recommended to replace the previous specifications of 1894:

(1) Under ordinary conditions of street arc-lighting, with lamps spaced 200 to 600 feet apart, specifications for street lamps should define the mean illumination thrown by the individual lamp, in position in the street, as measured at the height of the observer's eye and perpendicular to the rays, at some point not less than 200 feet, nor more than 300 feet distant, along a level street, from a position immediately below the lamp, with all extraneous light screened off and with no reflection from surrounding objects not forming part of the lamp equipment.[1]

(2) When using smaller units of light, such as series incandescent lamps spaced shorter distances apart, a correspondingly shorter distance from the lamp should be chosen in measuring the illumination.

(3) The lamp contracted for should give a mean normal illumination at the test point (selected as in Sections 1 and 2) not less than the illumination given by the stationary standard incandescent lamp of sixteen-candle-power at one-tenth of the distance. The said standard incandescent lamp should be a standardization seasoned lamp having a determined candle-power in a fixed direction.

(4) When the lamp tested fluctuates in intensity, a number of observations of the maximum normal illumination should be made at a distance of not less than 200 feet horizontally from beneath the lamp, and the average of these measurements should be taken as the average maximum illumination. A similar number of observations of the minimum normal illumination should be made, the average of which should be taken as the average minimum illumination. The arithmetical mean of the said average maximum and minimum illuminations should be taken as the mean normal illumination called for in Section 1.[2]

(5) A reasonable number of lamps covered by the contract should be tested.

(6) For measuring the mean normal illumination of a lamp, comparison with

[1] The reason for leaving the horizontal distance flexible along the street within the range between 200 and 300 feet, is that a definitely specified distance such as 250 feet might be unsuitable for the purpose of the measurement.

Within the horizontal distance in excess of 200 feet, the distance correction for the height of the lamp above the observer's eye is ordinarily unimportant.

[2] (a) When a reading-distance instrument is used for measuring the mean normal illumination at specified horizontal range, the average of a

the standard incandescent lamp may be made either with a suitable portable photometer or with a reading distance instrument, such as the so-called "luminometer."

(7) The unobstructed mean normal illumination must not be less at shorter distances than at the point of test.

(8) An approximate list of the mean normal illuminations thrown by street lamps of standard manufacture, at horizontal distances within the 200 to 300-foot range, hung approximately twenty feet above the level of the observer's eye is being prepared.

EXPLANATION BY DR. C. P. STEINMETZ.

The report does not claim to be a standard specification for street lighting, which merely needs to be signed by the lighting company and the board of aldermen and then be suitable for Washington, Portland or any other place.

The first conclusion of the committee was that while years ago it was possible to draft a standard specification for street lighting, applicable everywhere, since we had only one street illuminant, though perhaps two, or even three different sizes of it, now we have an enormous number of different illuminants, from the forty-candle-power series tungsten lamp to the flaming arc of thousands of candle-power, that it is impossible to draft a standard specification covering them all and merely requiring the signature of the parties interested.

The industry has advanced so far that it is no longer possible to have a universal specification, but we must have different specifications for the different existing street illuminants, those which exist to-day and those which will be brought out years hence.

The second conclusion the committee reached was that such a specification can not be a specification of the power consumed, but should be a specification of the light or illumination given, and then the committee concluded it should not be broadly or indiscriminately the light or candle-power in whichever direction it may be thrown, downward or hemispherically, but it should specify the candle-power in that direction in which it is desirable and necessary, that is in a direction slightly below the horizontal. The report further says, instead of specifying the current or candle-power, it should be made as intelligible to the layman as possible. The specification should read: We offer you a street lamp which at 250 feet distance will give you just as good illumination as a sixteen-candle-power incandescent lamp, as we buy it from the National Bureau of Standards, at thirty feet distance. The same company may, at half the price, offer a street lamp which at 125 feet distance gives an illumination that a sixteen-candle-power incandescent lamp gives at thirty feet distance. Another company may offer a street lamp which, at 250 feet distance, gives the same amount of light as a sixteen-candle-power incandescent lamp at twenty-five feet distance. The only point on which an agreement can be reached broadly is one based on the light given in the direction in which it is important to have it, and it should preferably be given by comparing it with the light of an incandescent lamp at a certain distance. Whether that should be 125 feet or 250 feet and should be the same amount of light as the incandescent lamp at twenty-five, thirty or forty feet is a particular which can be added to the specification as circumstances require. These things are all matters which relate to the particular contract in each case. Even should the committee work another year or not, it could not make any new recommendations with regard to these particulars. One company may make a proposition to furnish the light based on a comparison at 100 feet distance, compared with an incandescent lamp at twenty feet; and another company may make a proposition based on 200 feet distance compared with an incandescent lamp at thirty feet distance.

However, there may be a reason to continue the committee for another year and it may draft tentative specifications for certain well-known illuminants, for instance, for the carbon arc lamp or the magnetite lamp or the mercury vapor lamp. It may be well that any form of lamp, not yet existing, when it is introduced may have a committee of the association investigate it and present a report concerning it, and specify, perhaps, that the new form of lamp gives as much light at 250 feet distance as a sixteen-candle-power incandescent lamp at such and such a distance. That is also the meaning of a table which is to be added to the report. The table is not to form a part of the specification submitted to the board of aldermen; it is simply a table for the information of those members who desire to draw up contracts and desire to find out whether they should propose magnetite lamps or carbon lamps, and to enable them, from the table authorized by the association to find out the value of the different forms of illuminants. The illuminating company may select from the table the form of lamp they want to propose—the magnetite or mercury, and this table will enable them to draft a contract on the lines laid out, and providing that they agree to give as much illumination, or more, at 250 feet distance as the sixteen-candle-power incandescent lamp gives at thirty feet distance.

There is no possibility, at the present time or in the future that it will be possible to lay out a standard contract which only requires the signatures of the parties interested. That time is over. There is now a large variety of illuminants and it is growing from day to day. The condition which exists to-day must be faced and it is such that a standard contract covering all cases can not be drawn, but it is possible to lay out a form as to how the contract should be drafted and to give such technical data to the members of the association as will enable them to draft a contract to suit their particular conditions.

It is important to proceed immediately in this matter because all the new illuminants are superior in efficiency as regards power consumption, but cost more to install, and they would therefore be excluded from any contract, on a basis where, as at present, power is the criterion. Nothing would be gained by delaying action, as no new recommendations could be brought in by the committee. The principal thing in street illumination specifications is to specify the candle-power given in that direction where the light is most needed. The light should be such as to be the same, or more than an incandescent lamp at such and such a distance. More than this can not be specified in any contract. All that the committee can do in the future is to study some of the illuminants and obtain the technical data applying to them, but it will not improve the contract as a general contract.

number of maximum distances at which a certain size of print can be distinguished may be called the average maximum distance, and the average of a similar number of minimum distances the average minimum distance. From these, the mean distance at which an illumination is cast normally, sufficient for distinguishing that size of print can be determined. This mean distance must lie within the 200-300 feet horizontal range specified in Section 1. In most cases the arithmetical mean of the average maximum and average minimum distances may be taken as the said mean distance with an accuracy sufficient for practical purposes. The illumination needed for distinguishing the size of print may be determined for each particular observer from measurements of the reading distance with the standard incandescent lamp referred to in Section 3.

(b) When a portable photometer is used at a fixed horizontal distance, such as 250 feet, the mean normal illumination of a fluctuating lamp may be obtained by taking the average of not less than fifty observations at intervals of not less than one-half minute.

Boston Elevated Railway.

The Massachusetts railroad commissioners have approved an issue of $5,000,000 negotiable bonds by the Boston Elevated Railway Company for the purpose of construction, equipment and purchase of real estate. The bonds are payable in thirty years and bear interest not to exceed five per cent.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

Electric Traction by Means of the Auvert and Ferrand Regulating Rectifier.

A regulating rectifier or converter for electric railway purposes has been designed by Auvert and Ferrand, and is described here by A. Soulier. The principle upon which this depends is the following: If a gramme ring armature has but two coils, each wound over about one-quarter of its surface and placed opposite one another, and the sections of each coil be connected to a number of commutator segments, the remainder of the commutator surface being filled by two large segments, this device, when driven at a synchronous speed, and supplied with alternating current through slip rings connected to the two large segments mentioned, will deliver a rectified current from brushes resting upon the commutator. The potential thus obtained depends upon the position of the commutator brushes, and by varying the latter, may be varied at will. In practical form it is found desirable to utilize the unoccupied space upon the armature by means of two additional coils, which are connected as before to commutator segments, though the two sets of coils are not connected together. This gives the four-coil rectifier. It is also desirable to build the machine of the multi-pole type, the number of pairs of coils, of course, being increased in this way. The machine, it is said, operates easily without sparking. In use, two such machines are connected in series, the two sets of coils of each machine being in parallel. These two machines are then connected in series with the railway motors, the whole group of six machines being placed on a locomotive. In addition, transformers are necessary, the system being intended for converting current for direct-current motors and for controlling the latter, power being taken from a single-phase high-tension line. To test the apparatus, two such rectifiers were connected up so as to supply power to four motors, the latter being belted to generators to supply the load. Preliminary tests showed that the design of the machine might be improved, as the commutator and slip ring losses were considerable. The machine required, to run idle, 17.5 kilowatts, 4.6 kilowatts being absorbed at the commutator and 3.4 at the slip rings. The efficiency of the apparatus when thus tested, delivering 400 kilowatts, was 88.4 per cent; when delivering 105 kilowatts, 79.5 per cent. It is computed that if this system be employed, the efficiency from generator to locomotive axles should be about sixty-nine per cent. The machine may be used in a reverse sense—that is for retardation when descending grades, and thus absorb the power supplied by the motors and return it to the line.—*Translated and abstracted from L'Industrie Électrique (Paris), May 25.*

The Speed of Flicker Photometers.

Some experiments have been conducted by J. S. Dow to illustrate the connection between sensitiveness and speed when using the flicker photometer. In these particular investigations a grease-spot disc driven by a specially governed phonograph motor was employed, and the following method of defining the sensitiveness of the photometer was adopted. The movable source of light was brought up until the photometer appeared to be exactly in balance. The photometer disc itself was fixed. The positions on either side of the point where balance was obtained in which it could just be seen that the photometer was out of balance were then noted. The mean of a set of these observations enables one to determine the change of illumination on either side of balance which could be definitely detected by the photometer, and the reciprocal of this quantity was termed the sensitiveness of the instrument. Individual attempts at setting the photometer probably lie well within this range, and well within one per cent. This corresponds to a range of from eight to nine millimetres at the centre of a two-millimetre bench. With a Lummer-Brodhun photometer the author obtained considerably better results. Comparison was first made between lights of the same color, these being white. It was found that, when the photometer was in the position of balance, low flicker was visible at any speed, except when the speed was very low and imperfections in the photometer itself unbalanced the illumination. The chief results brought out by these experiments are for illuminations above ten candle-metres. The curves at different illuminations begin to coincide, and the photometer in each case maintained its sensitiveness at its maximum value over a range of frequency of about 450 to 1,100. For illuminations below ten candle-metres the higher speed becomes inadmissable, the range of frequency is more restricted, and the sensitiveness itself becomes less. Indeed, according to the author's experience, the flicker photometer seems to require an illumination of at least two to five candle-metres to be operated at all satisfactorily. A range of frequency of from 400 to 1,200 was found desirable when comparing lights of the same color. Next, sources of light differing in color were compared. Here the speed at which the greatest sensitiveness is reached is higher than before. Also, although the same order of sensitiveness as before is attainable, the range of speed over which it can be obtained is much more limited. For an illumination of twenty candle-metres the frequency should lie between 1,200 and 1,400. This result might have been expected, since the difference in color itself gives rise to a flicker if the speed is too slow, which flicker can be made to disappear for any position of the photometer, and therefore interferes with the possible accuracy of the instrument. The limiting point at which the flicker can just be made to disappear is not very definite experimentally. At an illumination of twenty candle-metres the frequency at which it becomes possible to get rid of the flicker is in the neighborhood of 1,250. At lower illuminations the sensitiveness of the instrument decreases. At illuminations above twenty candle-metres it is but slightly increased. The color difference used here was greater than is likely to occur in practice, a green being compared with a white light. The author concludes that, when comparing lights of the same color, the range of frequency over which the sensitiveness of the galvanometer is at its best is sufficiently great to make it an easy matter to select a satisfactory speed, and this speed should answer over the range of illuminations met in ordinary work; but if the illumination is low, a lower speed is necessary, and the sensitiveness is decreased. Also, when

comparing lights differing widely in color a higher speed is required, and the satisfactory range of speed is more restricted. Great exactness can not be expected in experiments of this kind, because the sensitiveness of the eye to a flicker is easily altered, and is particularly sensible to the effects of fatigue.—*Abstracted from the Electrician (London), May 31.*

The Design of Alternators as Influenced by the Rate of Speed.

The effect of speed on machines of large rated output is considered here by H. M. Hobart and A. G. Ellis. The authors first consider a machine for 6,000 kilovolt-amperes at 750 revolutions, and design three of these machines with four, six and eight poles respectively. They find that each of these designs is rational, and that there is very little difference in the quality of the result between the three. Where, however, a two-pole design is required for this speed, it would exhibit bad characteristics. In these designs a constant air-gap diameter was assumed, thus giving the same peripheral speed for all machines. In accordance with general principles, larger diameters should have been chosen for the machines of higher frequency. Had this been done, the weight of the eight-pole machine would have been reduced. Next, three machines for the same speed, each having eight poles, giving fifty cycles per second, but having, respectively, 1,500, 3,000 and 6,000-kilovolt-ampere ratings, are designed. It is found that the smallest machine could be favorably designed for 1,000 revolutions per minute, or even for 1,500 revolutions per minute, as may also the 3,000-kilovolt-ampere machine. Above 1,000 revolutions and six poles, however, approaches the undesirable range of speed for machines of 3,000-kilovolt-ampere rating. The most suitable speed for the 6,000-kilovolt-ampere machine is thought to be that assumed—750. In general designs for rated outputs of 2,000 to 3,000 kilovolt-amperes, the most satisfactory results are obtained when four poles are adopted. For larger machines the most favorable speed is that corresponding to six or eight poles. High speeds are not unfavorable to alternating-current design, and when not carried to excess, the higher the speed, the less will be the weight and cost of the machine. The value of the speed is, of course, dependent on the number of poles associated therewith to give the required frequency. It is pointed out that steam turbine speeds are more favorable to alternator designs than to continuous-current designs.—*Abstracted from Electrical Engineering (London), May 13.*

Recent Developments in Wireless Telegraphy.

After running rapidly over the early and important steps in the development of wireless telegraphy, Dr. Lee DeForest takes up in greater detail the more recent devices and improvements which have advanced this art. Among these devices are the electrolytic responder or "polariphone," the electrothermic receivers such as silicon and psilomelane, and the vapor receiver or "audion." The latter device is exceedingly reliable, and has excellent tuning qualities. The silicon receiver is interesting, since it does not require a local battery, the thermoelectric action set up by the received waves being sufficient to operate a telephone or other signaling device. The transmitting part of the problem has not made such satisfactory progress; in fact, but little has been done to explain the way in which the electrical waves are set up and radiated. Duddell and Taylor conducted some important investigations in this direction, but almost no progress has been made toward actually plotting the fields of force of these waves. However, it seems pretty well established that the energy of the electromagnetic wave varies inversely between the first and second power of its distance from the source. The wave therefore must not expand as the surface of a hemisphere, but of a hemisphere very much flattened. Many observed paradoxes are made clear by this theory, but there are a great many data to be collected and costly experiments to be made before the complete theory of overhead transmission and of varying conditions can be confirmed. One great desideratum is the discovery of a method whereby the propagation can be limited to any desired direction. Hertz's parabolic reflector is a clear solution, but only for waves of high frequency. The horizontal wave chute or artificial ground net is unable to solve the problem. Braun's work with several vertical transmitting antennæ is promising, but the accuracy demanded by this method has prevented its successful operation. The use of horizontal antennæ near the earth's surface is limited, because of the less distance attained than with the same length of vertical antenna. A compromise, in which an oblique antenna is employed, has given some valuable results. This phase of the problem is important, for it was found by the author in 1902 that a group of telegraph wires acts as a wave chute to confine a large amount of the radiated energy to a zone coaxial with such lines. In virtue of this effect, surprisingly long distances in transmitting wireless signals to trains have been attained. The author believes that this phenomenon offers to railway companies a means of keeping up their telegraphic service, even when the wires have been blown down by a storm. Another great problem is that of selectivity or syntonization. Here the value of the so-called loose coupling between oscillating and radiating systems is recognized. The best-known circuits accomplishing this to-day are embraced in the Stone system, which prevent interference if the frequency differs but one per cent. This degree of selectivity is ample for commercial requirements, but no matter how loosely coupled an oscillating system and its antenna circuit may be, the trains of waves sent out through any oscillator utilizing the ordinary spark discharge are too rapidly damped to allow the full benefits of the system to be attained. To overcome this, continuous oscillations must be set up and perhaps the most promising work in this direction is that started by Duddell with the singing arc, and improved later by Poulsen, who enclosed the arc in a neutral atmosphere. The author then points out that, given a continuous radiation of undamped waves or a radiation of undamped wave-trains in groups whose frequency is above the audible limit, or at least above the frequency of the more essential tones used in human speech, wireless telephony over commercial distances is comparatively easy of realization. The receiver for this system is already satisfactory, as those at present in use reproduce every change in the character of the spark now employed in transmitting wireless telegraphic messages. The author points out that for the transmission of radio-telegraph signals the medium required is ether at rest; that for radio-telephonic signals the medium should be ether in a continuous state of vibration. To vary the state of normal disturbances in the ether it suffices to vary the intensity of the spark itself, which is the origin of this disturbance; or to vary the intensity of the high-frequency currents. At the point of attachment to the earth these currents are greatest, the potentials are least, and this point is therefore the most sensitive and effective place in which to insert the intensity-governing device. This is a method on which Dr. DeForest is now working. He believes that radio-telephony has a wide field in all marine communication and between isolated points, in mountain and rural districts, in military field operations, and he ventures the opinion that if transatlantic telephony is ever accomplished it will be by means of the upper medium rather than by a submarine cable.—*Abstracted from the Journal of the Franklin Institute (Philadelphia), June.*

Methods of Getting New Business

A DEPARTMENT DEVOTED to the COMMERCIAL DEVELOPMENT of CENTRAL STATIONS

Managers are Invited to Contribute Suggestions for Methods of Increasing the Demand for Electric Service

EDITED BY CHARLES A. PARKER.

Advertising Electric Power.

You wouldn't give a man who is trying to sell you something half a day to do it in, Mr. C. S. Manager—why should any business man give your solicitor several hours to hear him expound the benefits of electric power?

Of course the solicitor is necessary to the central station, and a good solicitor is an invaluable asset; but please bear in mind that no solicitor can tell in a few minutes all the advantages of using current, and the average manufacturer is too busy to listen to the long talk of the solicitor.

Your prospective customer can not be presumed to know anything about electricity—the subject must be thoroughly gone into and every point emphasized in detail; this must be done in a manner that will arouse and hold the interest, and drive every good point home, in a concise and logical manner.

When this has been done, your solicitor can clinch the contract.

Suppose you were to receive a handsome booklet, setting forth the advantages to be derived from using electric power—you'd read it awhile, look over the illustrations, then throw it aside with a yawn, and say to yourself, "I know all that stuff by heart; what's the use—?" Yes, Mr. C. S. Manager, you know it all by heart and it doesn't interest you, but how about your prospective power consumer?

He doesn't know these things and is open to impressions.

Mr. Prospective Customer is a business man, and when the little booklet says to him, "You can save money," he wants to know how, and reads further. When he finds that he need not pay salaries for engineers, firemen or an electrician, he sits up and takes notice. When he is informed he does not have to pay bills for fuel, the removal of ashes, for repairs to boilers and engines, for water, oil, waste, and a hundred and one other necessaries of the private power plant, his curiosity has grown into a real interest to know more.

If your little booklet goes further and clearly demonstrates how, under present conditions, his plant is steadily depreciating; how he is losing the interest on his investment, the rental value of space, and the amount paid out for special insurance; besides what injury his building sustains from the heat and vibration, the risk his employés and the public are subjected to by the constant menace of boiler explosions always at hand, your prospective customer is just about ready to "sign up."

But if your book is really clever, it will go a little further.

It will show him he is paying unnecessary taxes on unnecessary machinery; that his belt transmission lines cost money to install, and more money to maintain. It will show him that his expensive shafting not only obstructs the light, but is a constant source of dirt and danger.

Then your booklet can start on another tack—the many advantages of individual motor equipment; how one machine may be worked independently of others; how electric power is always ready; how a turn of the switch will start a machine; how individuality is given to the work produced. In short, your booklet would thoroughly go into the increased efficiency, flexibility and output of motor-driven machinery.

A booklet like this will produce results, and you know it; it will give power users all the information desired before your solicitor calls on him; it will make him so anxious to know more about electric power for his particular business that he will most likely make a request for your solicitor to call upon him and explain matters further.

Yes, Mr. Central Station Manager, good advertising backed up with good solicitors is the most effective method of signing up power business.

Photograph showing the neat, artistically dressed window of the Mobile Electric Company, in which a young lady was placed to demonstrate the electric iron. The display attracted widespread attention, and so great were the crowds that thronged about the window, that the company was asked to withdraw the demonstrator.

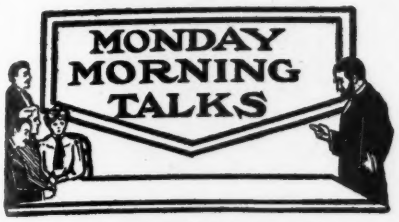
Right here is where you may make your greatest mistake. You may send out one good piece of advertising and expect it to accomplish the whole work.

It will not.

What is necessary is good, systematic follow-up advertising mailed out regularly and for a sufficiently long period.

It keeps prospects red hot, while your

solicitors are out gathering in the contracts.



Under this general heading we shall present to our readers a series of bright, stimulating talks to solicitors, which, we believe, will prove valuable to managers of new-business departments in suggesting points which they can profitably bring out in their occasional meetings with the company's representatives.

We shall gratefully accept contributions and suggestions from any of our readers.

Clinching the Contract.

Did you ever notice, fellows, that some solicitors have the happy faculty of getting a contract signed pretty nearly the first time they go after it?

It takes other solicitors two, three, or a half-dozen visits to accomplish the same object, even if they succeed in getting their prospect interested at all.

Other solicitors can give excellent reasons why their product should be used, and arouse considerable interest, but they seem to lack the ability to lead up to the

A Square Deal
"A Square Deal to every man—
no more—no less"
—President Roosevelt
DON'T you want to give yourself a square deal? With INDIVIDUAL ELECTRIC MOTORS, you pay for just the amount of power you use—no more,—no less,—You get "a square deal."
IN this age of keen competition, it is the little things that count.
Mobile Electric Company
Mobile, Ala.

An illustration showing the reading matter side of a power mailing card of the Mobile Electric Company. This mailing card contains some of the best power talk that one might find in many a day. It is strong, logical, argumentative and individualizes the uses of electric power very effectively in a few words.

point of signing—and then get the contract signed.

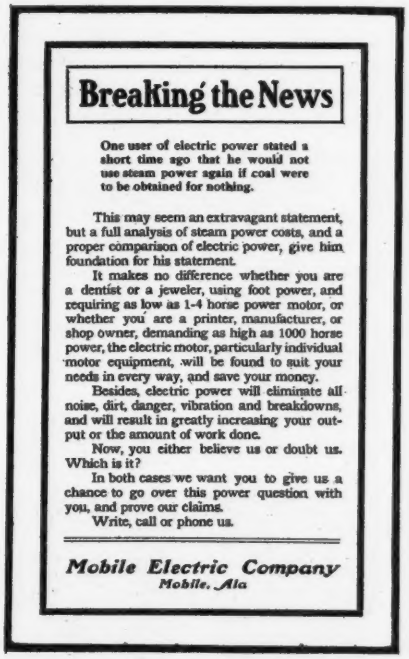
Now, this concern realizes that a certain amount of missionary work must be done.

We realize that some prospects will take a certain length of time to "think it over" in any event.

But don't get into the habit of thinking every case must be treated that way.

Study your man!

Be a judge of human nature.


Breaking the News
One user of electric power stated a short time ago that he would not use steam power again if coal were to be obtained for nothing.
This may seem an extravagant statement, but a full analysis of steam power costs, and a proper comparison of electric power, give him foundation for his statement.
It makes no difference whether you are a dentist or a jeweler, using foot power, and requiring as low as 1-4 horse power motor, or whether you are a printer, manufacturer, or shop owner, demanding as high as 1000 horse power, the electric motor, particularly individual motor equipment, will be found to suit your needs in every way, and save your money.
Besides, electric power will eliminate all noise, dirt, danger, vibration and breakdowns, and will result in greatly increasing your output or the amount of work done.
Now, you either believe us or doubt us. Which is it?
In both cases we want you to give us a chance to go over this power question with you, and prove our claims.
Write, call or phone us.
Mobile Electric Company
Mobile, Ala

A novel and very strong mailing card which formed part of the power service of the Mobile Electric Company. It is the sort of advertising which makes an impression.

If he can be landed on your first call, use every means you possess to get his signature to a contract.

Prove to him that it will be the best thing that ever happened to him to sign now.

Don't let him hedge and hesitate for a more convenient season.

Don't let him get away on any pretext whatever.

But put all your energy and selling ability into getting his name on the dotted line.

When you have succeeded in this, when you have got the habit of lining them up the first shot, you will surprise yourself at the ease with which it can be accomplished.

So I say, try and land that prospect the first time you call on him.

Fill him so full of your enthusiasm and belief in your product that he can't resist.

Show him where he needs it and is losing money without it, and the rest is easy.

But you must have faith in your goods.

You must be enthusiastic.

You must be sincere.

Have you all these qualities working every day?

Are you earnestly and determinedly using every working hour for rounding up new business?

We want to feel you are.

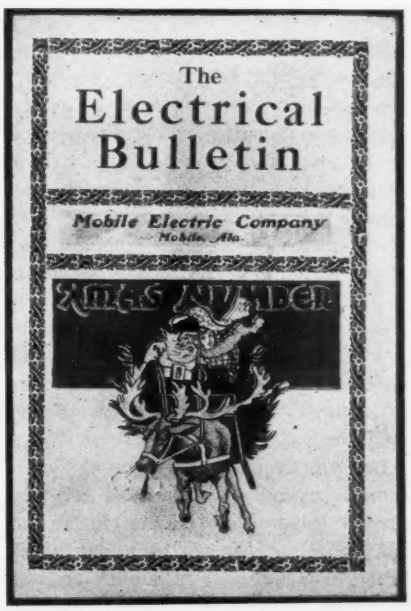
Not only for the good of this concern, but for your own good also.

It will be our endeavor, from week to week, to present in this department brief notices of activities among the central stations, as gathered from men who are in the field and, consequently, in close touch with the progress of the new-business idea and its acceptance by central station managers. Contributions to this department are solicited, and will be received with much appreciation by the editor.

If you are doing something a little better than or different from the other fellows, and think it would make interesting reading to ELECTRICAL REVIEW readers, send in your schemes and plans. They will be gladly received.

Address all communications to Charles A. Parker, care of the ELECTRICAL REVIEW.

Mobile, Ala.—Newspaper publicity, an excellent "Electric Bulletin," three direct-by-mail advertising services, consisting of high-class folders, booklets, mailing cards, etc., one to stores, another to prospective electric sign customers, and still another to power users, and this advertising backed



Christmas number of the "Electric Bulletin" sent out by the Mobile Electric Company. This publication ought certainly to be of very great value to the company. It is exceptionally attractive, very well illustrated, and the reading matter is unusually good.

up by displays, demonstrations, and an energetic corps of solicitors, is, in a nutshell, the whole story of the methods of

obtaining new business employed by the Mobile (Ala.) Electric Company.

A description of this advertising—how it is sent out, to whom, the arguments used, and its general make-up, toget with the methods used and success this company has had in greatly increasing its sale of current, will no doubt prove of great interest to central station men, and the endeavor will be made here to give as comprehensive an idea of the matter as possible.

The brains, energy and push behind the company and its advertising and the up-to-date methods of getting new business are embodied to a large extent in one man, Theodore K. Jackson, general manager of the company.

This gentleman is truly an ideal man for the position he holds. He has a thorough knowledge of most of the "ins" and all of the "outs" of the business of manufacturing and selling electric current. He is up to snuff in all the modern requirements that play their part in making a central station a success. He is full of energy, ambition and perseverance. And he has the faculty of knowing how to surround himself with the best and most efficient assistants.

As would naturally be supposed, Mr. Jackson has not the time to give personal attention to his company's advertising, and, like many other central station men are doing, he has placed the advertising in the hands of an advertising agency making a specialty of central station publicity.

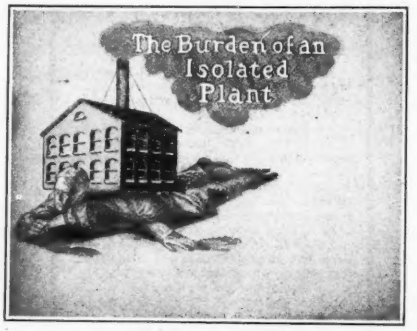
The company's contract with the agency calls for one thousand bulletins to be sent out the first of each month to a list of customers and prospectives which the company furnishes.

The advertising company compiles and prints the bulletin, addresses the envelopes, inserts the bulletins, stamps and sends them to the different parties on the list. Thus the Mobile Electric Company is relieved of all detail work, which usually requires the entire attention of one or more men.

The bulletin itself is gotten up in an elaborate manner and is one of the best sent out by any central station in the United States. It is a sixteen-page magazine, printed tastefully in delicate and attractive colors on enamel book paper. Its attractiveness is further added to by a handsome and entirely different cover design each month, and, by being profusely illustrated throughout, it is sure to be admired and kept by any one into whose hands it falls. It is like most other bulletins published by central stations, in that it covers the entire field of usefulness of electric current. It has something in it of interest to everyone.

Now as to other means of advertising employed by the Mobile Electric Company.

It selected a list of 200 stores which it wanted to interest in electric light for interior and show-window illumination, and contracted with the same advertising agency for a series of pieces of direct-by-mail advertising consisting of facsimile typewritten letters, mailing cards, book-

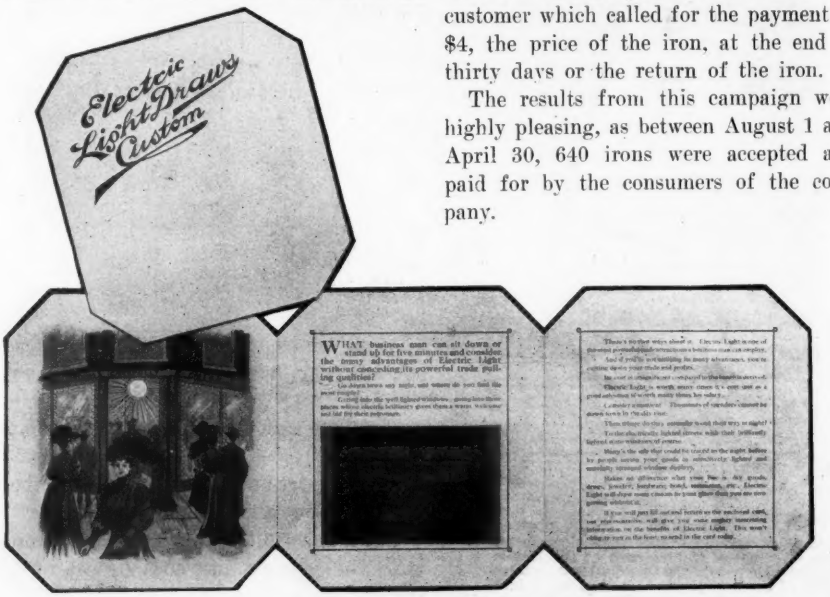


A highly suggestive and exceedingly well written power folder of the Mobile Electric Company.

lets and folders, to make up twelve different pieces, so that one piece would be sent out each month for a period of one year.

The list was sent to the agency and the advertising was sent out in the same way as the bulletins.

This store-advertising service tells merchants about the powerful trade-pulling



A simple, but very striking store folder of the Mobile Electric Company. It is uniquely gotten up, its reading matter is most excellent, and certainly of interest to merchants from start to finish.

qualities of electric light, the good impression a well-lighted store makes upon the people, the adaptability, the economy, and the hundred and one other advantages electric light has over all other forms of illumination for lighting up the interior of a store or its show windows. In fact, it arouses a desire on the part of the merchant to get in on the good thing which electricity affords him, at least to the extent of sending in the postal enclosed with each piece of advertising (except the mailing cards) for further information.

This gives the solicitor something to work on. It assures him of an audience, and if he is any good at all he will eventually land the interested merchant on some kind of a contract.

The company's "sign service" and also its "power service" is contracted for in the same manner. Its list for "sign service" consists of 150 merchants and business men who are good prospects to become users of electric signs, and its list for "power service" consists of fifty firms or individuals who might be interested in electric power.

Both these services are a series of direct-by-mail advertising literature along similar lines to its store service, and the return postal is enclosed in each piece.

Conjointly with this literature the company carried on a very effective campaign, looking to the introduction of electric flat-irons, by putting them out on thirty days' free trial.

A thorough canvass was made from house to house, leaving an electric iron wherever possible, with a request that it be tried. A receipt was taken from the customer which called for the payment of $4, the price of the iron, at the end of thirty days or the return of the iron.

The results from this campaign were highly pleasing, as between August 1 and April 30, 640 irons were accepted and paid for by the consumers of the company.

This showing is truly remarkable considering that at no time during the canvass was there more than one man engaged in this work, and only for a period of thirty days was his time exclusively de-

voted to canvassing for the electric iron. The man, or boy, rather, received $45 per month as salary.

During the time that he was putting out irons he placed, on an average, twenty irons a day. Of these irons 805 were accepted. While the number of irons accepted originally averaged about eighty per cent, the real average of the ultimate users was higher, as in many instances irons were returned and, subsequently, the same people called at the office and purchased new irons.

The company also undertook to introduce electric irons into laundries, by offering to install the irons, pay for all wiring and furnish the irons free on a sixty-days' trial, the irons and wiring to be paid for should the laundry decide to continue the use of the irons.

The result was that the laundries were highly pleased with the irons, and the owners assured the company that four girls could turn out as much work with the electric irons as five could with irons heated by gas or other methods. Aside from this it was found that there were fewer garments scorched. And to-day one of these laundries is operated entirely with electricity. Not only is electricity used as a motive power, and electric irons used for ironing, but the rolls on the larger machines are all electrically heated.

At the time Mr. Jackson was carrying on his energetic campaign of introducing electric irons he had the company's windows dressed to represent a high-class dining room with the usual sideboard, dining-room table, carpets, pictures, cut-glass, etc. In the windows was placed an ironing board, and he installed a nice-looking girl, dressed in a pretty white gown, to iron with an electric iron.

A placard was placed in the window with this statement:

"She does not have to wear her old clothes to do her ironing."

The window made a great hit and attracted such large crowds that the police requested the company to withdraw the girl from the window, and even then the window received a great deal of attention.

Mr. Jackson has a somewhat unique and extremely forceful way of impressing solicitors. He tells them that the company is not paying them their salary; but their salaries are paid by the consumers of the company. The company merely acts as a clearing-house, and their business is to look after the interests of the consumers. Their entire duty consists in obtaining the best and most out of the company for their consumers.

The contract department of the Mobile Electric Company is somewhat different from most central stations. It consists of three men, besides the man at the contract window—one man on power, one man on store illumination and signs, and one man on residence lighting and electrical devices.

Just to sum things up and to show that its advertising and methods of getting new business is a complete success, a few facts will be given as to the actual business added.

Its power department has contracted an average of 185 horse-power per month since its organization. The sign department has increased its business by $7,200 per year of flat-rate signs since January 1, 1907. The total number of contracts written from January 1, 1907, to April 1, 1907, was 650; this in face of an increase in lighting rates. This is a most creditable showing in a city the size of Mobile, which has only between 60,000 and 70,000 population.

The National Electric Light Association Convention Group.

Following the reception given on Tuesday, June 4, at the White House by President Roosevelt to the members and guests of the thirtieth convention of the National Electric Light Association, held in Washington, D. C., June 4, 5, 6 and 7, the party, about 900 strong, assembled in front of the Treasury Building and posed for the photograph, a reproduction of which is presented herewith. Owing to the belated service of the photographer it was not possible to present it sooner.

MEMBERS AND GUESTS OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION, THIRTIETH CONVENTION. TAKEN ON THE STEPS OF THE TREASURY BUILDING, WASHINGTON, D. C., JUNE 4.

The Seventh Annual Convention of the National Electrical Contractors' Association.

The seventh annual convention of the National Electrical Contractors' Association will be held in New York city, July 17, 18 and 19. The headquarters of the association will be at the Imperial Hotel, Thirty-first street and Broadway, and the meetings will be held in the Engineering Societies Building, 29 West Thirty-ninth street. A very interesting programme has been arranged, including addresses by James Hilton, president of the Electrical Contractors' Association of New York State; James R. Strong, president of the National Electrical Contractors' Association; Professor George F. Sever, consulting engineer of the city of New York; Arthur Williams, past-president of the National Electric Light Association; J. Robert Crouse, T. C. Martin, C. M. Goddard, secretary of the Underwriters' National Electrical Association, and Charles L. Eidlitz, first president of the National Electrical Contractors' Association.

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

Small Power Motors—Types GA and GD.

Aside from the various mechanical tools which are now commonly driven by small power motors, either direct-connected, belted, or geared there remain such mechanisms as the sewing machine, the letter sealing machine, the massaging outfit, hair drying outfit, hand drill, and the various forms of copying machines, printing presses, etc., to which the electric motor may be applied to great advantage.

Realizing the demand for such a motor, the Fort Wayne Electric Works, Fort Wayne, Ind., has developed a line of motors for both alternating and direct-current circuits. The motors of this line are built in sizes from one-one-hundredth horse-power up to one-thirtieth horse-power capacity.

Fort Wayne small power motors are classified as two distinct types, while the various designs of motors under each type have been given individual form letters to insure selection of the motor best suited to the consumers' needs.

Motors of the type GD are for use on direct-current circuits only, and are made in two sizes: 3⅝ and 5¼-inch frames. These are wound for speeds and output ranging up to one-thirtieth horse-power at 1,800 revolutions per minute, or one-fifteenth horse-power at 3,000 revolutions per minute. These are full-load speeds. Shunt motors, in large capacities have a practically constant speed, but in low capacities, as given above, there is a variation of fifteen to twenty-five per cent from no load to full-load speeds.

The 3⅝-inch frame motors are not made shunt-wound; the 5¼-inch frame motors are shunt-wound for 110 volts or less. Both frames are standard for series winding. In the series motor the speed varies with the load, so that the ratings mentioned refer to exact full-load. If the motor runs under light load the speed is apt to be excessive while if it is overloaded, the speed falls very much under normal. Type GD motors are made in Form CP only.

TYPE GA MOTOR.

For alternating-current circuits, type GA motors must be specified as this is a distinctly alternating-current motor, as distinguished from the type GD or direct-current motor. Type GA motors are designed for capacities up to one-thirtieth horse-power in the 3⅝-inch frame at 1,800 revolutions per minute. The same general conditions as to rated speeds exist in the type GA motors as referred to in the type GD motors. Type GA motors are designed in three different forms, enabling them to meet all the demands for application of alternating-current motors of small outputs.

Form CP is a commutator type alternating-current motor which can be supplied either as a series-wound or repulsion motor, either of which has speed characteristics similar to the series direct-current motor, the speed varying rapidly with change of load.

Form KP is a split-phase induction motor, having approximately constant speed at all loads, similar to the shunt-wound direct-current motor.

Form SP is an induction motor with shaded poles and squirrel-cage rotor, used only on 125 to 140-cycle circuits in the 3⅝-inch size frame.

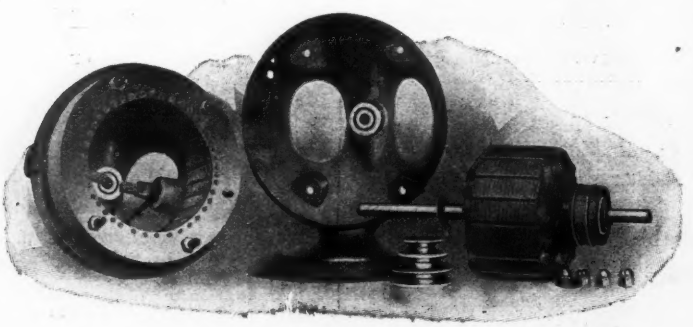
Frame—The frame of GD motors is rigid in construction and neat in appearance. It is cast in two pieces from a high grade of iron. The two sections of the frame are hemispherical in form and are supplied with two openings near either end of the shaft, by means of which the commutator and brushes may be examined. These openings also permit free circulation of air within the motor.

When assembled, the two parts of the frame form a nearly perfect hollow sphere, enclosing both armature and field in a very compact manner. The frame is supported upon an iron standard cast with one-half of the shell, permitting the motor to be located upon either floor, wall or ceiling, the whole presenting such an unbroken outline as to insure neat appearance and prevent accumulation of dust.

The field core is assembled by stacking together laminations of sheet steel, each being furnished with sufficient insulation upon its surface to prevent the formation of eddy currents.

The field is bipolar in design, the laminations being stamped in such form as to provide magnetic circuit, poles and pole tips entirely separate from the cast-iron frame.

The two field coils are wound and in-



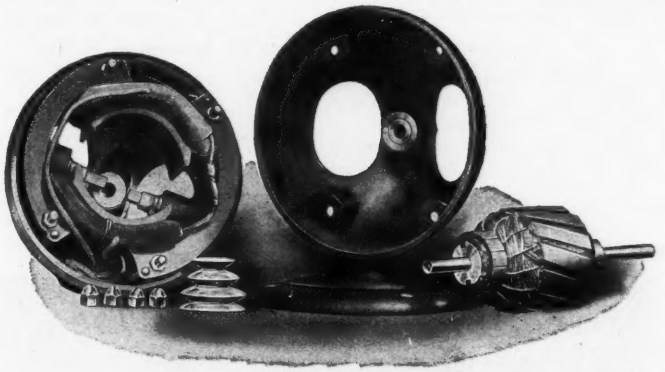
PARTS OF TYPE GA MOTOR.

SPECIAL DYNAMOTOR. 110 VOLTS SUPPLIED, FIVE VOLTS DELIVERED.

sulated in separate units, being made sufficiently flexible to slip over the pole tips. They are finally fitted tightly about the pole and securely fastened in such a manner as to prevent all vibration and consequent chafing.

Armature leads are soldered into slots in each commutator bar, the whole construction forming an armature which is in every respect equal to those of large machines.

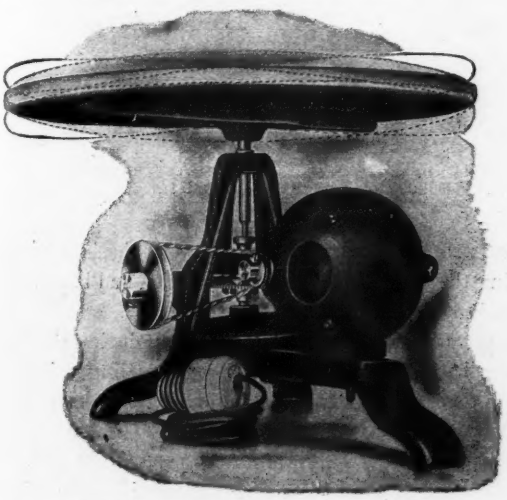
In order to form a suitable support for the brush-holders, lugs are cast inside the frame of the motor. These lugs are drilled and supplied with a tight-fitting fiber bushing through which the brass brush-holder tube is forced. Within this tube the carbon brushes are free to slide under the pressure of a coiled spring, the amount of compression in the latter being regulated at will from the outside of the motor frame.



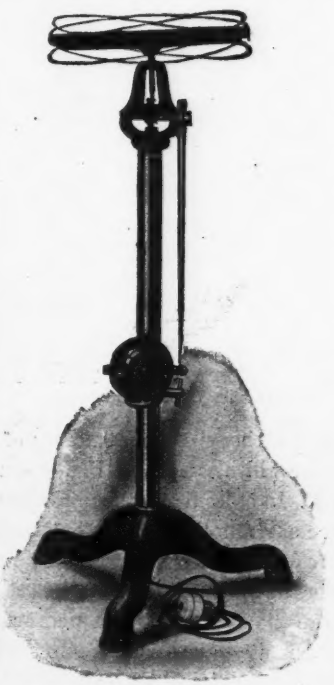
PARTS OF TYPE GD MOTOR.

The armature core is made up of laminations of high-grade sheet steel stamped in such form that when stacked upon the shaft, with the laminations slightly staggered, a complete cylindrical core is formed with slots in its surface, of constant depth, located at a slight angle with the shaft.

The laminations of the core are clamped in place between two brass collars, the latter being pinned securely to the shaft. In the smaller sizes one of the collars is threaded to a thin brass bushing made fast to the shaft, the former being forced into place by means of a key.



TYPE GD MOTOR OPERATING TITUBATOR OUTFIT.



MOTOR OPERATING TITUBATOR OUTFIT.

The commutator is constructed in a unit by itself, forced upon the shaft and firmly secured in place by means of a set-screw, the whole being independent of the armature core.

The armature coils are machine wound into the insulated slots of the core and secured in place by means of fiber wedges.

The bearings of these motors consists of bronze bushings centered in the frame of the motor. They are self-oiling in the 5¼-inch size frame, being constantly supplied with oil by means of a wick dipping into oil wells of liberal design supported beneath the bearings. In the 3⅝-inch sizes the bearings have longitudinal grooves filled with felt to retain the oil and afford lubrication. Fiber washers fixed to the shaft inside the bearings prevent any tendency of the oil to creep to the commutator or armature coils.

In assembling, the two halves of the frame are clamped together by means of through bolts, which in turn support the field core within the shell. These bolts pass entirely through the shell and are held in place by brass nuts tightened from the outside.

Motors of the GA type have been designed for use where small amounts of power are desired from alternating-current, single-phase systems.

They are similar in appearance to the direct-current motor, type GD, previously described, having a spherical cast-iron frame, with dimensions corresponding to those of form CP of the direct-current motor.

Type GA motors are self-starting and will operate mechanisms requiring power equal to that of the ordinary sewing machine with ease.

This motor meets the large demand for power for the operation of small appliances of a widely varied nature in households and offices where the only electric supply system is a single-phase alternating-current distribution for incandescent lighting.

Type GD and GA standard motors are furnished with three-step pulleys so that nearly all mechanisms may be readily operated by means of a belt.

Test of a 500-Kilowatt Allis-Chalmers-Parsons Steam Turbine and Allis-Chalmers Alternator.

Some interesting tests of a steam turbine have been made by H. L. Rice, general manager, and W. M. Willett, electrical engineer, of the Western United Gas and Electric Company, in that company's plant in Aurora, Ill. A description of these tests and the results obtained are given below.

DESCRIPTION OF UNIT.

The steam turbine is an Allis-Chalmers-Parsons standard horizontal turbine, rated at 500 kilowatts. The generator is a standard Allis-Chalmers turbo-alternator, direct-coupled to the turbine, and rated at 500 kilowatts. The condensing apparatus is of the Allis-Chalmers standard turbo-jet type.

The characteristics of the unit are as

follows: rated capacity, 500 kilowatts; speed, 3,600 revolutions per minute; frequency, sixty cycles; winding, two-phase; electromotive force, 2,200 volts; current per phase (normal), 114 amperes; construction of alternator, two-pole.

The turbine was built to operate normally with steam pressure at 140 pounds per square inch gauge pressure at turbine throttle; dry saturated; and a vacuum of twenty-eight inches of mercury, referred to thirty-inch barometer at exhaust nozzle.

The unit is calculated to carry an overload of fifty per cent when operating under the above steam conditions and at 100 per cent power-factor.

CONDITIONS OF TEST.

The time during which the turbine could be spared for test was limited from midnight Saturday to midnight Sunday; it was, therefore, decided to run only two tests, *viz.*, one at ten to fifteen per cent overload, and one at three-quarters load.

As the turbine was provided with a jet condenser, the steam consumption had to be determined by weighing the feed-water, and to correct this, it was necessary to make a boiler leakage test during the time available for test purposes.

To determine the amount of feed-water used, two barrels, "A" and "B," were placed on a platform and connected with one another by a short horizontal pipe introduced into the sides of the barrels near their tops. A water supply pipe with valves was brought over these barrels for the purpose of filling them alternately. Each barrel was provided with a large plug cock in its bottom. The barrels were carefully calibrated, and when filled so that the water would just enter the connecting pipe above-mentioned, they were found to contain: "A," 413 pounds, and "B," 391¼ pounds of water at fifty-eight degrees Fahrenheit. As the feed-water during the test was of a higher temperature, a correction has been made for the difference.

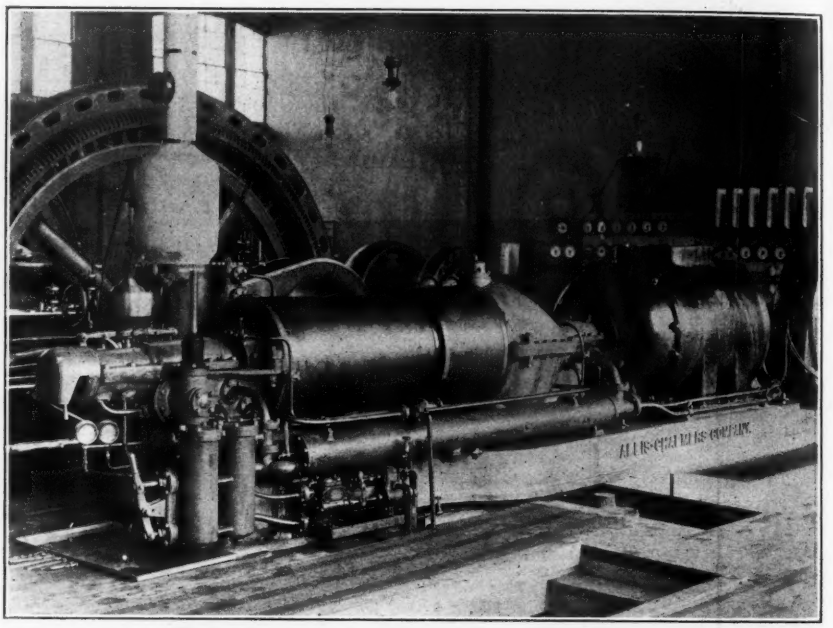
Under the platform, two receiving barrels were placed; into these the upper barrels emptied through the plug cocks mentioned. The lower barrels were connected with one another by a large horizontal pipe near their bottoms, and the suction pipe of the feed-pump was brought into one of the barrels.

Two Stirling boilers, of 250 boiler horse-power each, supplied steam to the turbine during the test. Each of the six drums of the two boilers was provided with a gauge glass and readings of the water levels in all six drums were taken at the commencement and end of the test, and also during the test. The blow-off pipes were blanked off, as were also the feed connections to the other two boilers in the station.

The auxiliary steam header for the feed-pumps, etc., was disconnected from the main header, and the portion of the main header receiving steam from the other two boilers in the station was separated from the portion receiving steam from the two boilers which furnished steam to the turbine during the test, by means of a gate-valve which was closed tightly during the test. In order that there might be no leakage of steam through this valve, the pressure on all boilers was maintained at about the same point throughout the test, so that both sides of the valve were under approximately the same pressure. From the header supplying the turbine a pipe ran to a 200-kilowatt Hamilton-Corliss engine, which was shut down during the test, and the angle-valve on the header shut off the pipe. Provision was made, near the engine throttle, to catch the drains from this pipe, but they were found insignificant and were disregarded.

The condensed steam from the steam header, as also from the steam separator near the turbine throttle, was discharged into barrels filled with a gauged quantity of cold water. As the water accumulated, it was taken out in buckets and weighed, and when the water in the barrel became sufficiently hot to vaporize, a weighed quantity of cold water was added. At the end of each test the water in the barrel was brought back to the original quantity.

The feed-pump for supplying the calibrated feed-water to the boilers was a Duplex outside-packed plunger pump. The leakage from this pump was caught and returned to the lower feed-water supply barrels. It was not necessary, therefore, to keep records of this leakage.



500-KILOWATT, SIXTY-CYCLE ALLIS-CHALMERS STEAM TURBINE AND ALTERNATOR AT WESTERN UNITED GAS AND ELECTRIC COMPANY, AURORA, ILL.

The steam gauges were checked by an inspector's test gauge which had been verified shortly before.

The quality of the steam during the test was determined by a throttling calorimeter, introduced into the steam pipe just below the separator at the turbine.

A water rheostat was used for providing load for the turbo-unit. Electrical readings were taken from the regular switchboard instruments in the station, and also from a set of calibrated instruments.

Between the overload and three-quarters load tests, the boilers were tested for leakage. To determine this, all valves were closed after the boilers had been filled to marks on the gauge glass, and the boilers kept under a steam pressure of 150 pounds per square inch for four hours. A calibrated quantity of water was then

put into the boilers to bring the water level back to the original marks.

The following are the results of the test:

TEST OF 500-KILOWATT ALLIS-CHALMERS TURBO-GENERATOR, AURORA, ILL.

1.	Average load	570.8 kilowatts
2.	Per cent of rated load	114 per cent
3.	Duration of test	4 hours
4.	Steam pressure at turbine throttle	143. 3 gauge
5.	Steam pressure at turbine inlet	123.02 gauge
6.	Vacuum turbine exhaust	26.77 inches
7.	Barometer	29.5 inches
8.	Vacuum at turbine referred to 30-inch barometer	27.22 inches
9.	Revolutions per minute	3,600
10.	Temperature of feed water	78.8
11.	Total water used corrected for temperature	48,544 pounds
12.	Drips from steam header	318.75
13.	Drips from steam separator	68.25
14.	Boiler leakage	1,927 pounds
15.	Moisture in steam by calorimeter	5.12 per cent
16.	Actual weight of water chargeable to turbine	43,878.23 pounds
17.	Actual consumption of dry steam per kilowatt per hour	19.21 pounds

WESTERN UNITED GAS AND ELECTRIC COMPANY.
(Signed) H. L. RICE, General Manager.
(Signed) W. M. WILLETT, Electrical Engineer.

SECOND TEST OF 500-KILOWATT ALLIS-CHALMERS TURBO-GENERATOR, AURORA, ILL.

1.	Average load	385.8 kilowatts
2.	Per cent of rated load	77.5 per cent
3.	Duration of test	4 hours
4.	Steam pressure at turbine throttle	142.4 gauge
5.	Steam pressure at turbine inlet	87.0 gauge
6.	Vacuum Turbine exhaust	27.57 inches
7.	Barometer	29.45 inches
8.	Vacuum at turbine referred to 30-inch barometer	28.08 inches
9.	Revolutions per minute	3,600
10.	Total water used corrected for temperature	34,552.0 pounds
11.	Drips from steam header	397.0 pounds
12.	Drips from separator	91.5 pounds
13.	Temperature of feed water	86.16° F.
14.	Boiler leakage	1,927 pounds
15.	Moisture in steam by calorimeter	4.48 per cent
16.	Actual weight of water chargeable to turbine	30,612.01 pounds
17.	Actual consumption of dry steam per kilowatt per hour	19.82 pounds

WESTERN UNITED GAS AND ELECTRIC COMPANY.
(Signed) H. L. RICE, General Manager.
(Signed) W. M. WILLETT, Electrical Engineer.

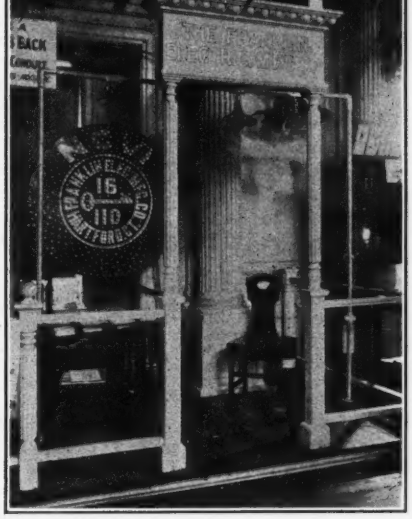
The Cutler-Hammer Manufacturing Company Purchases the Wirt Electric Company.

In announcing the purchase of the Wirt Electric Company, Philadelphia, Pa., the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., announces for the information of its customers and those of the Wirt Electric Company, that the manufacture of Wirt apparatus will be continued by the former company. Pending the incorporation in the Cutler-Hammer catalogue of apparatus of the Wirt type, the current Wirt catalogue should be used. Copies of this catalogue may be obtained from the Wirt Electric Company, of Philadelphia, the Cutler-Hammer Manufacturing Company, Milwaukee, or on application to any of the district offices.

The purchase of the Wirt Electric Company will enable the Cutler-Hammer Manufacturing Company to meet more fully the requirements of the trade. For many years certain types of Wirt apparatus have enjoyed an enviable reputation. Particular attention is called to the complete line of battery charging rheostats developed by the Wirt company, and to the Wirt field rheostats, which in 1902 were awarded the John Scott medal on recommendation of the Franklin Institute of Pennsylvania.

The National Electric Light Association Exhibit of the Franklin Electric Manufacturing Company.

One of the interesting exhibits at the recent National Electric Light Association convention, held in Washington, D. C., was that of the Franklin Electric Manufacturing Company, Hartford, Ct.,



THE BOOTH OF THE FRANKLIN ELECTRIC MANUFACTURING COMPANY AT THE NATIONAL ELECTRIC LIGHT ASSOCIATION EXHIBIT AT WASHINGTON, D. C., JUNE 4-7.

a view of whose booth is presented through the courtesy of the company. A feature of this exhibit was the facsimile of the "Novi" label made up of miniature incandescent lamps. This is well shown in the accompanying illustration. There were also shown the company's Gem and tantalum lamps equipped with Holophane reflector. The exhibit was designed by P. S. Klees.

Allis-Chalmers Company Secures Large Order for Alternating-Current Generators.

The United States Steel Corporation has awarded to the Allis-Chalmers Company, Milwaukee, Wis., orders for thirty-two gas-engine-driven electric generators, aggregating 68,000 kilowatts, sixteen of which are to be installed in the new plant at Gary, Ind., now in course of construction by the steel corporation. The other sixteen units are for the Homestead plant of the Carnegie Steel Company, the South Chicago and Bay View (Milwaukee) works of the Illinois Steel Company, and for the central furnaces of the American Steel and Wire Company at Cleveland, Ohio.

These are Allis-Chalmers standard type, 25-cycle, three-phase alternators, and will be direct-connected to Allis-Chalmers twin-tandem gas engines, operated on blast furnace gas, which is the gas collected at the tops of furnaces and formerly allowed to go to waste.

At the Gary plant of the Indiana Steel Company the rail mill will probably require the greatest amount of power. This mill is situated about a half-mile from the power-house in which the sixteen units will be housed, and will consume approximately 10,000 kilowatts to operate the induction motors which drive the main rolls. These motors range in capacity from 2,000 to 6,000 horse-power, and three of them have overload capacity of 9,000 horse-power for an hour.

Tungsten Lamps for Series Incandescent Street-Lightfng Service.

The General Electric Company, Schenectady, N. Y., announces that it is ready to supply tungsten lamps for series street-lighting service. The application of incandescent lamps to street-lighting service should be widely extended by reason of the advantages tungsten lamps possess for this class of service. They can be supplied in low candle-power sizes permitting distribution of lamps at frequent intervals, thereby securing maximum economy with uniform and satisfactory lighting.

The high efficiency now obtained by the tungsten lamp will enable central station companies to compete successfully against any other form of street illuminant of low or moderate candle-power.

Tungsten lamps are particularly adapted to series-lighting service, as the lamps are employed in low voltages which permit the use of short, stable and durable filaments.

General Electric tungsten lamps will be supplied in forty and sixty candle-power in the following ampere ranges: Four, 5.5, 6.6 and 7.5 amperes. Forty candle-power is considered the minimum desirable candle-power for this class of illumination. Present 3.5-ampere systems can increase their current to 3.8 and 3.9 and thus come with the four-ampere range.

Current Electrical News

DOMESTIC AND EXPORT.

CHICAGO TRACTION COMPANY LIKELY TO BE SOLD—Unless within fifteen days the bonded debt of the Chicago Electric Traction Company, Chicago, Ill., amounting to more than $1,000,000, is paid with the interest, the property and franchises of the company will be sold at auction. This is the effect of a decree of Judge Kohlsaat, of the United States Circuit Court, filed June 12. The line is the old storage battery road which ran from Sixty-third street and South Park avenue, Chicago, to Blue Island and Morgan Park.

TO ISSUE $25,000,000 BONDS—A bond issue of $25,000,000 has been authorzied by the Birmingham Railway, Light and Power Company, Birmingham, Ala. The amount will retire the outstanding bonds, $10,000,000, leaving $15,000,000 for improvements. The money will be spent at the rate of about $1,000,000 a year, in line with the plan of the company inaugurated six years ago to spend this sum every year on improvements. The largest immediate expenditure will be the erection of a power plant, which probably will be located in the coal fields of the district, where fuel can be supplied without haulage.

CHICAGO CITY POWER FROM DRAINAGE CANAL—The Chicago city council has unanimously authorized the mayor and the controller to make a contract with the drainage board for the use of electric power to the amount of 7,000 horse-power a day. In the contract the city is allowed to say whether it wants the power delivered for twenty-four hours a day or for an average time of eleven hours a day, varying according to the time of the year, the longest hours being in the winter months. The price the city is to pay is $1.25 a horse-power-day on the eleven-hour schedule, and $2.20 on the twenty-four-hour schedule. In case of excess use in an emergency, the price is to be proportionate. The city obligates itself to use the power thus acquired only for municipal purposes and not to sublease or transfer its contract.

NEW WESTERN POWER COMPANY—Orlando B. Willcox, Horace G. Lunt and John F. Adams, of Colorado Springs, Col., who represent Eastern capital, have incorporated the Idaho-Nevada Power Company with a capital stock of $7,500,000. The object of the company is to furnish light and power to mining companies of Idaho and Nevada, construct electric railways and light towns. The directors are Orlando B. Willcox, Horace G. Lunt, D. B. Ellis, L. B. Johnson, George A. H. Frazer, W. A. Reef, Charles I. Hawthorne and J. C. Darling. Headquarters will be maintained in Denver, Col. This concern is to be an auxiliary to the Central Colorado Power Company, recently incorporated in Colorado with a capitalization of $22,000,000. In this concern are Myron T. Herrick, former governor of Ohio, Thomas F. Walsh, David H. Moffat, Curtis & Hine, of Colorado Springs, and a number of other prominent capitalists of Colorado and the East.

NEW NIAGARA FALLS ELECTRIC LIGHT AND POWER COMPANY ORGANIZED—The Utility Construction and Operating Company has been organized and incorporated with a capitalization of $1,000,000 for the purpose of distributing electrical power for light and commercial purposes. Of the capitalization $50,000 is in stock and the rest is taken up in a bond issue. Prominent residents of Niagara Falls, N. Y., who are large users of electrical power are behind the new company. The president is James E. Rock, owner of the Cataract Haircloth Factory. The promoters of the company have been working for some time past completing their plans, which are now announced. The Niagara, Lockport & Ontario Power Company will generate the power on the Canadian side of the river at the plant of the Ontario Power Company. The price of commercial and private lighting will be reduced from the figure given by the old company, and a determined bid will be made to secure business. The company also intends to put in a bid for the lighting of the city of Niagara Falls next fall, when the present contract with the Buffalo & Niagara Falls Electric Light and Power Company expires.

ELECTRIC LIGHTING.

MANCELONA, MICH.—The city electric light plant burned on May 30, entailing a loss of $4,000. The plant was fully insured.

SAYRE, PA.—The Sayre Electric Company has been granted a franchise by the borough council of Sayre for a period of thirty-five years.

CLEBURNE, TEX.—The Cleburne water, ice and lighting plant has been sold to G. P. Jones, of Tyler. The plant is worth $150,000 or $200,000.

OMAHA, NEB.—The Omaha Electric Light and Power Company has let the contract for a $6,000 transformer house at Twenty-seventh and Lake streets.

FREDONIA, KAN.—The Fredonia Ice Company is taking steps toward the installation of an electric light plant, for which plans and estimates have been submitted.

HARDWICK, VT.—The Daniell electric light and power plant at Hardwick has been sold to the Woodbury Granite Company. The consideration was said to be $28,000.

ARMOUR, S. D.—Dr. B. W. LaShier has applied for an electric light franchise. He promises, if such a franchise is granted, to begin the construction of a plant at once.

VASSAR, MICH.—At a special election Vassar decided to bond for $10,000 for the purpose of securing an electric lighting system. Out of the 274 votes cast, 270 were in favor of the proposition.

COLORADO SPRINGS, COL.—The Manitou Electric Company, owned and controlled by Dr. W. A. Bell, has been awarded the contract to furnish the town of Manitou with lights for the next five years.

AUBURN, N. Y.—Stockholders of the Citizens' Light and Power Company have sold their holdings to the American Gas and Electric Company, which is the owner of the Auburn Light, Heat and Power Company.

BLOOMFIELD, IOWA—Pulaski, a village of 400 population southeast of Bloomfield, is agitating a proposition to install an electric light plant. The majority of the citizens are in favor of the improvement.

WRENTHAM, MASS.—The town of Wrentham voted, at a special town meeting, to erect a municipal electric light and water plant. The sum of $50,000 was voted for the water plant and the appropriation for the electric light plant will be decided at a later meeting.

SULPHUR, COL.—The Eastern Colorado Power Company proposes spending $1,500,000 in building reservoirs and a power plant near Sulphur on Middle Boulder creek. The Northern Colorado Power Company is building a power plant at Lafayette, a short distance from Sulphide.

SACRAMENTO, CAL.—Professor C. L. Corey, head of the department of engineering at the University of California, will estimate the cost and maintenance of a municipal lighting plant. It has been suggested that the city issue ten-year bonds and have the plant erected by a private concern.

ROCKFORD, ILL.—The Rockford Edison Company has possession in escrow of the plant and business of the Central Heat and Power Company, and if the terms of the agreement entered into by the officers of the two companies can be carried out, the Edison company will absorb the business.

TOLEDO, OHIO—The Toledo Railways and Light Company has decided to offer a lower rate for the lighting of the city parks with arc lights for five months in the year. The price for the entire year is, by contract, $45. The company now offers to supply the park lights for five months for $33.

NETCONG, N. J.—Edward T. Wills, who about five years ago erected an electric lighting plant in Mt. Olive township, and secured the contract for street lighting in Netcong and Stanhope, has sold the plant and business to a company composed of local and out-

side capitalists, organized by D. M. Cook, of Newark. The new company will be incorporated.

BELOIT, WIS.—It is stated that the Rockford Edison Electric Light Company, which furnishes power for the Rockford City Railway, has purchased the great power plant of the Rockford Interurban Railway, and will sell power to the interurban and Beloit City railway lines.

MANILA, PHILIPPINE ISLANDS—The new contract between the municipal board and the Manila Electric Railroad and Light Company for the improved system of street lighting has been approved by the advisory board. All the incandescent lights are to be removed and their places taken by arc lamps.

RED BLUFF, CAL.—M. O. Ballard, J. T. Cameron and C. S. Barnes have made new filings on the waters of Mill creek, each claiming 20,000 inches under a four-inch pressure. The water is to be used to generate electricity and electric power and the proposed power plant is to be located near the bank of Mill creek.

FRANKFORT, KY.—The Union Light, Heat and Power Company, of Covington and Cincinnati, has filed amended articles of incorporation with the secretary of state, reducing its capital stock from $1,500,000 to $500,000, and also an amendment providing its indebtedness shall never exceed four times the amount of its capital stock.

NEWARK, N. J.—The proposal of the Public Service Corporation to furnish light for the city at the rate of $70 per arc light, a four-year contract, was favorably acted on by the Board of Works recently. The present scale of $95 will be reduced to $75 until September of next year, when the still lower scale of $70 will go into effect.

COLUMBUS, GA.—At a meeting of the Columbus city council that body committed itself to the proposition for ordering an election for $700,000 bonds for the erection of a municipal lighting plant unless the city can be furnished lights at $60 per lamp of 2,000 candle-power, and ten cents per kilowatt-hour to private consumers.

READING, PA.—The Shamokin & Coal Township Light and Power Company has absorbed the plants of the Shamokin Electric Light and Power Company, the Shamokin Arc Light Company, the Shamokin Gas Light Company and the Edison Electric Illuminating Company by merger, the purchase price being $275,000.

ALBANY, N. Y.—The state gas commission has received an application from the village of Sherburne, Chenango county, for permission to issue $15,000 in bonds for the purpose of establishing a municipal electric lighting plant. The people of that village have voted in favor of such a proposition. The estimate as to the cost of the plant was made by H. B. Sweet, of Utica.

TOPPENISH, WASH.—Several persons have been looking over the field with the expectation of building an electric light plant, and it is probable that a franchise will be submitted for a system which will furnish light and power to the city. If low rates are not offered to Toppenish the city council may decide to erect a municipal plant, which will be run in connection with the water system.

LANCASTER, PA.—The election ordered by council to ratify an ordinance granting an electric franchise to J. H. and M. S. Witherspoon and John T. Stevens resulted in the defeat of the proposition. This is the second election of the kind held in less than sixty days, both resulting in defeat of the franchise ordinances. It is believed that a more advantageous proposition may be made later on.

MINNEAPOLIS, MINN.—Minneapolis has taken the first step toward a municipal electric light plant. By unanimous vote the city council has passed the Dwyer municipal electric light ordinance which provides for converting the unused down-town pumping stations into electric light plants. The plan is first to supply the city with the electricity needed for public lighting and later to develop the plant to the point where it can supply private consumers.

WASHINGTON, D. C.—The Potomac Electric Power Company has taken out a permit for the erection of a two-story concrete power-house on Bennings road to cost about $14,000. The plant of this company at this point is an extensive one, and the additions that are and will be made will make it one of the most complete plants of its kind in the country. The plans were prepared by Architect Frederick B. Pyle, and the contract of construction has been awarded to Frissell & Wagner.

CAMDEN, N. J.—The stockholders of the South Jersey Gas, Electric Light and Traction Company have elected these directors: David Baird, Thomas C. Barr, Frank Bergen, J. H. Blackwell, Frank O. Briggs, John J. Burleigh, Forrest F. Dryden, Colonel A. R. Kuser, John D. Kuser, Rudolph V. Kuser, Thomas N. McCarter, Uzal H. McCarter and W. J. Thompson. These officers were selected: president, Colonel A. R. Kuser; vice-president, John J. Burleigh; secretary, Frederick Evans; treasurer, Charles G. Cook.

GEORGETOWN, COL.—A dividend of three and one-half per cent was declared upon outstanding preferred stock of the United Hydro-Electric Company for the half year just ended at the special meeting of stockholders called for the purpose of ratifying the sale of the company's holdings to the Eastern Colorado Power Company for $750,000. All shares outstanding, 4,000, were represented. The directors were clothed with full power, with instructions to close the deal if possible. It is believed this will be done within thirty days.

PASADENA, CAL.—Judge Olin Wellborn, sitting in the United States Circuit Court, has denied the petition of the Edison Electric Company for an order restraining the city of Pasadena from disposing of $125,000 bonds, voted May, 1906, for the acquisition or erection of a municipal lighting plant. The ground taken by H. H. Trowbridge, attorney for the Edison Electric Company, was that the establishment of a municipal lighting plant would be unconstitutional because it would be exempt from taxation, putting the competing private corporation at a disadvantage.

BOWLING GREEN, KY.—The Green River Hydraulic Electric Company has awarded contracts for all except the electric machinery for their plant which is to be erected at Glenmore locks, on Green river. The concrete work will be done by Troslite & Company; the steel work by Grainger & Company, and the turbines furnished by the Trunk Turbine Company, all of Louisville. The plant is being erected for the purpose of generating electricity to be used for lighting and power purposes in Bowling Green. The water flowing over the dam at Glenmore will furnish the power for the plant.

COLUMBUS, OHIO—Professors E. A. Hitchcock and F. C. Caldwell, of Ohio State University, who were employed by the board of public service to test the municipal electric light plant because it had been said that an unnecessary expenditure of $90,000 was about to be made for additional machinery, in a preliminary report made to the board differ with those who claim the equipment of the plant is sufficient. The report says the plant is in need of additional machinery, not only for the proposed increase in the number of lamps, but even to carry the present load. They recommend the purchase of one 500-kilowatt machine for carrying the present load, with no increase in the number of lamps.

TORONTO, ONTARIO—The Ontario government has confirmed the Kaministiquia Power Company in the rights which it took over, as assignees of Edward S. Jenison, to generate power at Kakabeka Falls, on the Kaministiquia river, near Port Arthur and Fort Williams. The conditions are that the company is to pay the government at the rate of twenty-five cents per horse-power per annum on all power in excess of 10,000 horse-power, in return for which the government undertakes to build, maintain and control the dam at Dog Lake for storage purposes. In addition to this, the government will regulate the flow out of Dog Lake for the general benefit of all the water powers developed on the river, including that of the Kaministiquia Power Company. This settlement is the culmination of a long contest between Mr. Jenison and the Clergue interests. Latterly the Kaministiquia Power Company, which now holds the Jenison interests, has been the principal figure in the fight. The company went to a very large expense in development works at the falls, with the object of providing power for the twin cities of Port Arthur and Fort William and the manufactories of those towns. Among other things, the company surrenders the right to build dams at Dog Lake and at other places.

NEW INCORPORATIONS.

AUSTIN, TEX.—Central Texas Telephone Company. $50,000.

ALBANY, N. Y.—Gowanda Bell Telephone and Telegraph Company, Gowanda. $35,000. Directors: J. D. Hardy, Boston; C. S. Phelps and B. J. Crawford, Gowanda.

AUSTIN, TEX.—The Livingston Electric Light Company, of Livingston, Polk county. $2,000. Incorporators: H. B. Davis, J. E. Hill, Jr., D. E. Drew and J. W. Cochran.

COLUMBUS, OHIO—The Erner Electric Company, of Cleveland. Increase in capital stock from $5,000 to $125,000, $25,000 of the increase being seven per cent preferred.

DES MOINES, IOWA—Lanyon Mutual Telephone Company, of Lanyon, Iowa. $5,005. Incorporators: G. T. Peterson, J. Albert Anderson, Gust Burge, J. A. Burman, Edward Peterson, D. E. Carlson, Limas Goodale and I. L. Reedholm.

VINCENNES, IND.—The Hydroelectric Company. To erect a dam at Decker for the purpose of generating electricity for light and power. $10,000. Directors: Eugene Rush, Lucius C. Embree, John Gatton, Harry R. Lewis and Edgar H. DeWolf.

SALEM, ORE.—Douglas & Coos Electric Railway Company, Marshfield. To build and maintain a line of railroad and a telephone and telegraph line between Roseburg and Marshfield. $500,000. Incorporators: A. C. Marsters, L. H. Hazard, P. L. Phelan, L. J. Simpson, Edgar L. Wheeler, J. H. Flannigan.

COLUMBUS, OHIO—The Akron, Canton & Youngstown Railway Company, of Canton. To operate in Summit, Stark, Portage and Mahoning counties, the terminals of the road being Akron and Youngstown. $200,000. Incorporators: Z. W. Davis, Isaac H. Taylor, William Simpson, H. B. Stewart and M. L. Rackle.

COLUMBUS, MISS.—The Columbus Light and Railway Company, Columbus. To build, acquire by purchase, equip, maintain and operate an electric light and power plant in the city of Columbus for a period of fifty years. $300,000. Incorporators: Charles F. Sherrod, William Baldwin and Walter Weaver.

HARRISBURG, PA.—Central Allegheny Valley Telephone Company, East Brady. $3,000. Directors: R. A. Thomas, C. Homer, F. L. Ludwick, J. W. Hill, C. P. McCafferty, Keystone Mining Company, T. G. Jones' Sons, R. W. Steele, Graham Brothers, East Brady; E. D. Jennings, W. J. Mildren, E. M. Queen, Queenstown.

HARRISBURG, PA.—Crucible & Belle Bridge Company; to build a line from Clinton to the boundary line of Allegheny and Washington counties; $24,000. Belle Bridge Company; to build a line from Glassport to Elizabeth; $15,000. Directors of both companies: D. B. Neagley, E. L. Keen, J. K. Neagley, George McKain and N. F. Bickering, Pittsburg.

NEW MANUFACTURING COMPANIES.

TOLEDO, OHIO—The Toledo Electric Sign Company has been incorporated at Columbus for $5,000 by Henry E. Burkhart, Edwin J. Marshall, William R. Hodge, Conrad Weil and William H. McLellan, Jr. The company will manufacture modern electric signs.

NEW YORK, N. Y.—The Metropolitan Electric Stage Lighting Company has been incorporated with a capital of $10,000 to manufacture electric stage-lighting apparatus. The incorporators are: Alexis Olenin and Ada Olenin, and Arthur A. Taylor, all of New York city.

TROY, N. Y.—A certificate of incorporation of the Hinsdale-Pickering Electrical Company has been filed with the county clerk. The incorporators are Charles A. Hinsdale, Howard Pickering, Aimee R. Hinsdale and Corinne E. Pickering. The company will engage in general electrical work and has a capital of $5,000.

PORTLAND, ORE.—Articles of incorporation of the W. H. Judson Company have been filed, the purpose of the company being to engage in the manufacture of rolling stock for steam and electric lines. The capital stock is placed at $250,000, and the incorporators are: W. H. Judson, president; G. F. Martin, vice-president, and M. Wilson, secretary. The men behind the enterprise are said to be local railway, sawmill and business men.

TELEPHONE AND TELEGRAPH.

CASTLEDALE, UTAH—The Eastern Utah Telephone Company is installing a local telephone exchange in Castledale.

DENVER, COL.—The Carrizo and Kenton extension of the Lamar-Springfield telephone system is being built.

LEXINGTON, KY.—A telephone line will be constructed along the line of the Queen & Crescent Railroad from Somerset to Cincinnati. The system from Somerset to Oakdale has been completed.

NORTH YAKIMA, WASH.—J. P. Reed, representing the Independent Telephone Company, has applied to the city council for a franchise. It is the intention of the company to make North Yakima the headquarters for Eastern Washington.

LEXINGTON, KY.—A suit asking for a receivership for the Home Telephone Company, Lexington, is based on the allegation that the company has raised its rates contrary to its charter and has illegally declared dividends, and asks that it be compelled to pay back to patrons $200,000 alleged excessive tolls and cancel a $300,000 mortgage to the Cleveland Trust Company.

PEKIN, ILL.—The Citizens' Telephone Company, in connection with the Home Telephone Company, of Canton, will construct a line between this city and Canton, each company to bear half of the expense. The Citizens' Telephone Company has completed the metallic line to Washington and patrons of the company now receive service to that city, Eureka, Minonk, Roanoke, Metamora, Deer Creek and East Peoria. Heretofore the service has been by way of Spring Bay.

DENVER, COL.—A contract has been signed by the Colorado Telephone Company with the United States forest service by which the company grants various concessions in consideration of the free right of way for its lines over the national forests. The forest service will receive free use of the company's lines through the national forests for official messages, and half rates for the use of its lines between points situated beyond the boundaries of the forests. The service will also have special rates in the purchase of instruments and line supplies. The company will construct desirable lines in many cases in cooperation with the service. The free use of timber is granted to the company for poles in the construction of lines in the national forests, and pole timber will be sold to the company when needed for lines built outside the forests.

ST. JOHNSBURY, VT.—The Passumpsic Telephone Company is a new Vermont corporation which has acquired the interests in Caledonia, Orleans and Essex counties of the New England Telephone and Telegraph Company. The board of directors includes Lieutenant-Governor G. H. Prouty, of Newport; M. M. Taplin, of Barton Landing; E. M. Taft and George C. Cary, of St. Johnsbury, who constitute a majority of the board. C. A. Brown, of Newport, formerly assistant treasurer of the Orleans Trust Company, is the general manager. The new company will start with about 3,000 subscribers. Its territory includes the towns of Barnet, Waterford, Danville, Concord, Kirby, Standard, St. Johnsbury, Lyndon, Victory, Granby, Burke, Wheelock, Sheffield, Sutton, East Haven, Ferdinand, Newark, Barton, Westmore, Brownington, Irasburg, Lowell, Westfield, Jay, Troy, Newport, Coventry and Derby.

EDUCATIONAL NOTES.

RENSSELAER POLYTECHNIC INSTITUTE—The opening exercises of the Carnegie Building and the Dr. William Weightman Walker chemical laboratory of the Rensselaer Polytechnic Institute were held at Troy, N. Y., on Wednesday, June 12. The address at the dedication of the Carnegie Building was delivered by Emil Swensson, and the address at the dedication of the Walker chemical laboratory was delivered by William McMurtrie.

STEVENS INSTITUTE OF TECHNOLOGY—The commencement exercises of the Stevens Institute of Technology were held in the auditorium of the institute, Hoboken, N. J., on June 13. The graduating class was addressed by the Honorable Paul Morton, ex-secretary of the United States Navy, and president of the Equitable Life Assurance Society. The honorary degree of Doctor of Engineering was conferred upon John Fritz. The salutatory address was delivered by Alexander Murdoch Norris, and the valedictory by Oliver C. Traver.

PERSONAL MENTION.

MR. WILLIAM J. AGER, superintendent of construction for the Spokane Traction Company, Spokane, Wash., has resigned.

MR. W. E. PHELPS, president of the Phelps Company, of Detroit, Mich., was a New York visitor last week. Mr. Phelps states that his company sold about 150,000 "Hylo" turn down lamps during the past twelve months.

MR. H. S. PIERCE has been appointed to take charge of the Postal Telegraph Company's office at Richmond, Ind., to succeed Newton M. Aldrich, who has been transferred to one of the Chicago offices. Mr. Pierce comes from La Salle, Ill., to Richmond, having been connected with the Postal company in that city.

MR. EDGAR S. FASSETT, general manager of the United Traction Company, Albany, N. Y., has been elected to the board of directors, and made a member of the executive committee of the company. Mr. Fassett takes the place of William J. Mullin, resigned.

MR. C. E. WHITE has succeeded E. E. Miller as manager of the new-business department of the Union Gas and Electric Company, Cincinnati, Ohio. Mr. White has had a wide experience in the electrical field, having been manager of the Wakefield (Mass.) municipal electric light plant, and previous to this having been connected with the Philadelphia Electric Company.

MR. E. J. BECHTEL, for thirteen years superintendent of the lighting department of the Toledo Railways & Light Company, Toledo, Ohio, has resigned and will move to New York city where he has accepted the position of consulting engineer for Hodenpyl, Walbridge & Company. C. R. McKay, engineer of the Cincinnati (Ohio) office of the General Electric Company, has been appointed to succeed Mr. Bechtel.

MR. HENRY S. YOUNG, JR., was given a farewell dinner in view of his leaving the electrical field in New York, for that of Philadelphia, having severed his connections with J. H. Bunnell & Company, to identify with the H. C. Thomas Electrical Supply Company, of Philadelphia. Among those present at the dinner, which was given in Kalil's restaurant, New York city, were: J. H. Shaper, V. C. Gilpin, Marston Cockey, E. T. Rice, Asa R. Shipman, A. C. Landres and W. B. McCurdy.

MR. J. M. GRAHAM, vice-president of the Erie Railroad, was the recipient of the honorary degree of Doctor of Engineering from the Kentucky State College, at its thirty-ninth annual commencement on June 4. Mr. Graham's most notable work in engineering has been on the Baltimore & Ohio and Erie railroads. He was, in turn, superintendent, general superintendent and chief engineer of the Baltimore & Ohio road, and prior to this connection was general manager and chief engineer of the Northern Pacific & Manitoba Railroad, superintendent and assistant general superintendent of the Northern Pacific Railroad, and chief engineer of various other railroads.

DATES AHEAD.

Jamestown Tercentennial Exposition. Norfolk, Va., April 26 to November 30.

American Society for Testing Materials. Annual meeting, Atlantic City, N. J., June 20-22.

American Institute of Electrical Engineers. Annual meeting, Niagara Falls, N. Y., June 25-28.

New York State Street Railway Association. Annual meeting, Pine Bluff Point, N. Y., June 26-27.

Society for the Promotion of Engineering Education. Case School of Applied Science, Cleveland, Ohio, July 1-3.

National Electrical Contractors' Association. Annual meeting, New York city, July 17-19.

Illuminating Engineering Society. Annual meeting, Boston, Mass., July 30-31.

International Association of Municipal Electricians. Norfolk, Va., August 20-22.

Ohio Electric Light Association. Annual meeting, Toledo, Ohio, August 20-22.

Canadian Electrical Association. Annual convention, Montreal, Quebec, September 11-13.

Railway Signal Association. Annual meeting, Milwaukee, Wis., October 8-10.

ELECTRICAL SECURITIES.

The stock market last week developed a sluggish attitude, which in large measure characterizes the state of affairs throughout the land in general. While it may seem an indication of little wisdom to say that the weather conditions which have been visited upon the entire north temperate zone are almost wholly responsible for this, yet it is a fact that the backwardness of the season is held in many quarters as resulting in the withholding of immense amounts of money which usually change hands through retail channels at this period of the year. It is easy also to make the step of eliminating luxuries when events have made it essential to do without many comforts which are usually considered of the ordinary character. And when there is a tendency toward simplicity in domestic affairs it is usually because of an intuitive sense that a like trend toward retrenchment is due in business circles. Notwithstanding so many near-adverse conditions, however, there still remains a feeling of cheerfulness, and a disposition to believe that what difficulties there may be due to increased cost of material and backwardness of season, these will be susceptible of ready adjustment. The failure of the firm of Milliken Brothers is a warning to those who would spend overmuch in creating new opportunities and leave not enough to work these opportunities up to a self-supporting condition, for no matter what the collateral, when money is scarce it's hard to get it. The veto by Governor Hughes of the two-cent railroad bill in New York state, and the splendid argument laid down as to his reasons for so doing, have been applauded by all sorts and conditions of people, and seem to indicate a sentiment that is fast taking hold, that simple justice, after all, is what the corporation as well as the man on the street are entitled to.

ELECTRICAL SECURITIES FOR THE WEEK ENDING JUNE 15.

New York:	*Closing.*
Allis-Chalmers common	10
Allis-Chalmers preferred	28¼
Brooklyn Rapid Transit	52
Consolidated Gas	116½
General Electric (ex-dividend)	137¾
Interborough-Metropolitan common	15½
Interborough-Metropolitan preferred (ex-dividend)	44
Kings County Electric	119
Mackay Companies (Postal Telegraph and Cables) common (ex-dividend)	66
Mackay Companies (Postal Telegraph and Cables) preferred (ex-dividend)	64
Manhattan Elevated (ex-dividend)	132¼
Metropolitan Street Railway	85
New York & New Jersey Telephone	112
Western Union	79¾
Westinghouse Manufacturing Company	142¼

Directors of the General Electric Company have declared the regular quarterly dividend of 2 per cent, payable July 15 to stockholders of record June 15. Books do not close.

The directors of the Western Union Telegraph Company have declared the regular quarterly dividend of 1¼ per cent, payable July 15 to stockholders of record June 20. Books closed June 20 and will reopen July 1.

Boston:	*Closing.*
American Telephone and Telegraph (ex-dividend)	104¼
Edison Electric Illuminating	205
Massachusetts Electric	55
New England Telephone	110
Western Telephone and Telegraph preferred	69

Philadelphia:	*Closing.*
Electric Company of America	9½
Electric Storage Battery common	48
Electric Storage Battery preferred	48
Philadelphia Electric	7⅞
Philadelphia Rapid Transit	22⅛
United Gas Improvement	90⅞

Chicago:	*Closing.*
Chicago Telephone	124
Chicago Edison Light	138
Metropolitan Elevated preferred	62
National Carbon common	71
National Carbon preferred	111
Union Traction common	—
Union Traction preferred	—

At the annual meeting of the Chicago Edison shareholders held June 10, the old board of directors was reelected, but before action on the election of officers was taken the meeting took an adjournment to Monday, July 15, on account of the probability that the board of directors would presently recommend a consolidation of the company with the Commonwealth Electric Company. For the same reason the annual meeting of the Commonwealth Electric Company held some time ago has also adjourned till July 15. The merger has been expected for a long time, and is regarded as a foregone conclusion.

ELECTRIC RAILWAYS.

AMITYVILLE, N. Y.—The village board has granted a franchise to the Huntington & Babylon Railroad Company.

ELIZABETH, N. J.—The Morris County Traction Company has been granted a forty-year franchise by the town of Summit.

SOUTHPORT, N. Y.—A franchise has been granted to the Elmira, Corning & Waverly Railroad Company.

BELLEFONTAINE, OHIO—The Schoepf Traction Syndicate has purchased a ninety-acre farm west of this city. It is reported that a power-house will be erected.

GRAFTON, W. VA.—The directors of the Grafton Traction Company have let the contract for the construction of the company's street railway to Talbott Brothers, of Fairmont.

PEORIA, ILL.—The Peoria, Bloomington & Champaign Traction Company has certified to the secretary of state at Springfield an increase in capital stock from $5,000 to $500,000.

TAYLORVILLE, ILL.—The city council has granted a franchise to the Springfield & Southeastern Traction Company. The company will begin work at once.

WORCESTER, MASS.—The Uxbridge & Blackstone electric street railroad has passed into the control of the New York, New Haven & Hartford interests.

VANCOUVER, WASH.—The Washington Railway and Power Company, of Vancouver, filed, on May 21, at Olympia, Wash., a certificate of increase of capital stock from $150,000 to $500,000.

ROCKVILLE, MD.—It is announced that the Washington & Rockville Railway Company will soon begin the work of extending its road, which now connects Washington and Rockville, to Gaithersburg.

SAN BERNARDINO, CAL.—H. E. Huntington has taken over the lines of the San Bernardino Valley Traction Company, and the company's headquarters will be transferred to Los Angeles. There will be no change in the personnel.

DUNKIRK, N. Y.—The Buffalo & Lake Erie Traction Company has entered into an agreement with the Ontario Power Company for electrical power for the main Buffalo and Erie line, Dunkirk system, and all suburban lines in this territory.

COBALT, ONTARIO—J. W. Fitzpatrick and the Hon. Frank Latchford, directors of the new Nipissing Central Railway Company, want to construct an electric road from Cobalt to New Liskeard at once. Their charter empowers them to build and operate from Temagami to Abitibi.

NEW YORK, N. Y.—The Nassau Electric Railroad Company has mortgaged its property to the Central Trust Company for $5,000,000. The mortgage is for ten years from March 29, 1907. The Brooklyn Elevated Railroad Company mortgaged its property for $20,000,000 to the Central Trust Company for ten years.

NEW YORK, N. Y.—The board of estimate and apportionment has granted a franchise to the Fort George Street Railway Company to construct an overhead trolley from the Dyckman street station of the Interborough Rapid Transit Railway upon and along St. Nicholas avenue to its intersection with West 190th street. There was no opposition to the granting of the franchise.

CANANDAIGUA, N. Y.—The promoters of the Canandaigua-Southern Electric Railroad, through the Bristol valley, from Canandaigua to Naples and thence to Atlanta, in Steuben county, have filed the documents necessary to permit them to extend the road six miles farther than was originally intended, so as to reach Wayland.

CINCINNATI, OHIO—At the annual meeting of the Mansfield Railway, Light and Power Company, the old board of directors retired and the following were elected: S. N. Ford, C. F. Ackerman, F. L. Fuller, T. W. Latham, C. S. Sotherden, Reid Carpenter, A. S. Huey and George Koehler. S. N. Ford was elected president and S. A. Foltz secretary. A good statement of earnings for the year was made.

WASHINGTON, D. C.—It is said by an officer of the newly built electric road to the Great Falls that during the seven months of last year, which is the time the road was operated from the date of its completion, the net earnings amounted to over two per cent on a capital of $2,000,000. This year, with the double-track road, which was not available last year, it is expected a dividend of good size will be paid from the earnings of the company.

ROME, N. Y.—A special meeting of the stockholders of the Rome City Street Railway Company will be held June 22 in Rome, for the purpose of voting upon a proposition to increase its capital stock from $150,000 to $500,000. Notices to this effect, signed by Horace E. Andrews as president, have been sent out. The proposed increase is to allow for future extensions. It is understood that it applies particularly to a contemplated electric line extending west from Rome.

ONANCOCK, VA.—Word has been received from Umberhauer & Company, of Philadelphia, that it will take the issue of $100,000 thirty-year five per cent bonds of the Accomac Traction and Power Company. This, with the stock subscriptions, will be sufficient to complete the road from Onancock to Tasley, thence to Accomac Courthouse, thence to Metompkin Bay, the aggregate distance being about nine miles. Work will be commenced in a short time and pushed to completion.

CHICAGO, ILL.—North Shore capital is being interested in a project for an electric line from Lake Forest to connect the Lake county summer resorts. It is proposed to run the line to Fourth Lake on the north, Round Lake on the west, Gray's Lake on the south, with connections to some of the other lakes in that vicinity. This line would reach all of the important resorts in McHenry county, many of which now are remote from steam and electric lines.

BLOOMINGTON, ILL.—The McKinley system of interurban electric railways is preparing to operate through trains between St. Louis and Danville, which is situated practically on the Illinois-Indiana state line. The connecting line between Decatur and Champaign is finished, except the erection of a bridge across the Sangamon river, east of Decatur. Work is progressing on the bridge, and as soon as it is done there will be a direct route from St. Louis *via* Springfield and Decatur, to Danville.

BUCYRUS, OHIO—The city council has granted two electric railway franchises. A franchise was granted to the Columbus, Marion & Bucyrus Electric Railway Company, having a line in operation between Columbus and Marion and an extension now building from Marion to Bucyrus. The second franchise was to the Toledo, Bucyrus & Columbus Electric Railway Company, with a line under contemplation from Fremont to Bucyrus *via* Tiffin and Melmore. The line has been surveyed, all franchises granted and partially financed. These two links will connect Toledo with Cincinnati.

ST. LOUIS, MO.—The farmers along the survey of the old St. Louis & Sioux City railroad have made a tempting offer to railroad companies with a view to getting an electric road through from St. Charles to Vandalia, Mo. If the offer is accepted by any road, a long-needed route will be completed for the transportation of passengers between these towns, as well as a heavy freight service. The farmers state that they will give $1.00 an acre on all lands lying within a few miles of the proposed line to the amount of $500 per mile, and give as a bonus the right of way to any company that will build the line. The territory along the survey of the old St. Louis & Sioux City Railway Company is one of the richest in the state, not only in agriculture, but in undeveloped coal fields, and is thickly populated.

WESTERLY, R. I.—A reorganization of the Pawcatuck Valley Street Railway Company has been effected by a committee of bondholders consisting of E. P. Shaw, Jr., of the Boston & Worcester Street Railway Company; H. F. Walker, president of the Warren National Bank, of Peabody, Mass., and Rufus Coffin, of the firm of Rufus Coffin & Company, investment brokers. This railroad defaulted on its interest November 1, 1906. It had bonds for $100,000 first mortgage, $40,000 second mortgage and capital stock $75,000. A majority interest of the bonds and stocks was owned by W. L. Mauran, of the Westerly Light and Power Company, and by an arrangement with the committee the outstanding bonds were cancelled and a new mortgage of $50,000 was placed upon the property, with an additional amount of $14,000 contributed by the bondholders, which money has gone into permanent improvements and is now covered by the new mortgage. This road runs from Westerly to Watch Hill and has a large summer patronage.

INDUSTRIAL ITEMS.

THE H. B. CAMP COMPANY, 85 Hartford Building, Chicago, Ill., E. V. Johnson, western manager of sales, announces a new series of attractive folders on the use of Camp conduit. The company will be glad to mail this literature to any one interested.

THE WESTINGHOUSE MACHINE COMPANY, East Pittsburg, Pa., has published a handsome booklet describing the Westinghouse storage battery and illustrating the method of assembling and the various forms in which this storage cell is furnished.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., announces that its Seattle, Wash., office, in charge of G. W. Pulver, district manager, has been moved to 115 Jackson street.

HARVEY HUBBELL, INCORPORATED, Bridgeport, Ct., and New York, N. Y., has found it necessary to increase the personnel of the New York office, which is under the management of H. W. Bliven, by adding Smith T. McLean to the staff. Mr. McLean has been at the factory in Bridgeport, but from now on he will be identified with the sales department.

THE STANDARD VARNISH WORKS, 29 Broadway, New York city, has published a new catalogue devoted to S. V. W. insulating specialties. A feature of this catalogue is the "Insulator's Index," reference to which indicates the varnish or compound best suited for various classes of work; there are also several pages devoted to the latest means of insulation, that is, by drying and impregnating in vacuum. This system is being rapidly introduced into the shops of large electrical manufacturers and electric railway repair shops. Copies of this catalogue will be furnished by the company upon request.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has ready for distribution the following new literature: price list No. 5,165, Edison miniature incandescent lamps (carbon filament); bulletin No. 4,493, parts of R controllers; No. 4,498, Thomson single-phase, high-torque induction wattmeters; bulletin No. 4,499, cast-grid rheostats, type CG; bulletin No. 4,502, G. E. knife-blade switches, type L, form D-12; bulletin No. 4,503, CQ generators and balancer sets; bulletin No. 4,508, commutating pole railway motors; bulletin No. 4,510, electrically operated, ratchet-driven, rheostat switches; bulletin No. 4,511, lightning arresters, 1907 types; and booklet illustrating and describing the electrification of the West Jersey & Sea Shore Railroad.

THE HOLOPHANE COMPANY (sales department), New York city, has recently enlarged its offices and now occupies the eighth and ninth floors of the Glaeckner Building, 227 Fulton street. The engineering department of the company is composed of some of the best-known illuminating engineers in the country. The company has opened a branch office at 157 Minna street, San Francisco, Cal., under the management of F. H. Poss, who is well known to the trade on the Pacific Coast. A large line of globes and reflectors will be carried at this office which will enable it to make prompt deliveries. Only standard packages will be sold.

THE LEEDS & NORTHRUP COMPANY, Philadelphia, Pa., has published an elaborate catalogue describing in detail its electrical measuring instruments. The apparatus is illustrated in detail, and careful descriptions are given of the characteristics and use of each instrument or auxiliary. A number of instruments are catalogued for the first time, as follows: No. 2,400, portable telescope galvanometer; No. 4,305, Kelvin bridge; direct-reading ohmmeter; dial decade portable testing set; No. 5,420, fault finder; No. 5,365, bridge for locating faults in power circuits; No. 7,000 alternating-current-direct-current comparator; No. 5,513, alternating-current generator and commutator; synchronizing and speed controlling apparatus; resistance thermometer.

THE NERNST LAMP COMPANY, Pittsburg, Pa., has published a series of very attractive and handsome advertising literature devoted to lighting with various forms of Nernst lamps. An attractive booklet is entitled, "A Departure in Office Buildings," describing the lighting features of the Larkin Administration Building. Other publications are entitled, "Electric Lighting in the Department Store," "The Lighting of Public Buildings," "The Art of Lighting," "Maximum Economy in Electric Lighting," "Bank and Office Lighting by Electricity," "The Nernst Lamp," "The Style and Distribution of Nernst Lamps for Effective Illumination," "The Nernst Series-Alternating Vertical-Glower Street Lighting System." There is also the June issue of "The Glower."

Record of Electrical Patents.

Week of June 11.

856,260. TELEPHONE APPARATUS. William Kaisling, Chicago, Ill., assignor to Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. An enclosing case for telephones.

856,273. RAILWAY SWITCHING SYSTEM. William Macomber, Buffalo, N. Y., assignor to General Railway Signal Company, Buffalo, N. Y. An electrical system for operating a rail switch.

856,275. HIGH-TENSION ELECTRIC FIXTURE. Albert S. Marten, East Orange, N. J., assignor to the Tea Tray Company, Newark, N. J. An electric lamp fixture.

856,277. ELECTROLYTIC TANK. John F. Miller, Trail, British Columbia, Canada. A wooden electrolytic tank.

856,290. SIGNALING MECHANISM. Walter A. Pearce, London, England. An electromagnetic signal.

856,292. SAFETY FUSE. William J. Phelps, Detroit, Mich. An enclosed fuse.

856,321. ELECTRICAL CONTACT-JOINT. Reinhold H. Wappler, New York, N. Y. A flexible connector.

856,324. RAILWAY SWITCH-OPERATING AND SIGNALING SYSTEM. Asbury G. Wilson, Wilkinsburg, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. A motor-operated railway switch.

856,328. THERMOSTATIC APPARATUS. Edward F. Woodman, Boston, Mass. A thermostatic circuit-changer.

856,393. ENCLOSED FUSE. Robert C. Cole, Hartford, Ct., assignor to the Johns-Pratt Company, Hartford, Ct. A case for an enclosed fuse.

856,412. ELECTRIC METER. Arthur J. Martin, Rugby, England, assignor to General Electric Company. A recording meter.

856,414. DYNAMOELECTRIC MACHINE. Charles A. Mudge, New York, N. Y., assignor to Electro-Dynamic Company, Bayonne, N. J. A dynamo with symmetrically spaced pole faces, but unsymmetrically spaced pole cores.

856,417. ELECTRICAL CONTROLLER FOR STEAM PLANTS, ETC. John A. Olson, Minneapolis, Minn. An electrically controlled steam valve.

856,422. GEAR-CASE. William J. Reich, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. A gear-casing for a railway motor.

856,423. VENTILATING DYNAMOELECTRIC MACHINES. Henry G. Reist, Schenectady, N. Y., assignor to General Electric Company. Fan blades mounted on the armature.

856,424. CONTROLLING AN ELECTRIC CANDY-SPINNING MACHINE. Albert D. Robinson, Lynn, Mass., assignor to General Electric Company. The heating circuit can be closed only when the motor is running.

856,425. CIRCUIT-BREAKER. Benjamin P. Rucker, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. A circuit-breaker operating in a plane perpendicular to its base.

856,429. COMMUTATOR BRUSH. Robert Siegfried, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. A brush with a flexible metallic connector.

856,430. SYSTEM OF ELECTRICAL DISTRIBUTION. Simon B. Storer, Syracuse, N. Y., assignor to Westinghouse Electric and Manufacturing Company. A two-phase system employing auto-transformers.

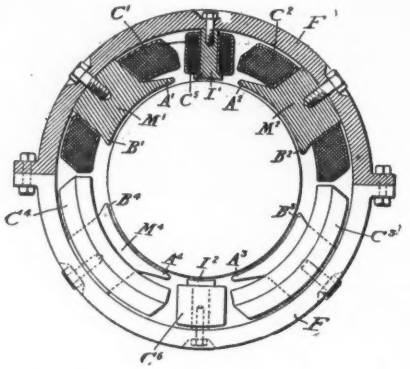
856,433. CENTRIFUGAL SWITCH FOR ELECTRIC MOTORS. Knut Tornberg, Lynn, Mass., assignor to General Electric Company. A centrifugal short-circuiting switch for induction motors.

856,440. BLOCK-SIGNAL SYSTEM. Elmer F. Bliss, Schenectady, N. Y., assignor to General Electric Company. An alternating-current open-circuit signaling system.

856,441. MAXIMUM-DEMAND INDICATOR. Francis H. Bowman, Pittsfield, Mass., assignor to Stanley-G. I. Electric Manufacturing Company. A liquid indicator.

856,448. CONTROL SYSTEM FOR ELECTRIC VEHICLES. William Cooper, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. A multiple-switch controller.

856,465. BLOCK-SIGNAL SYSTEM. Laurence A. Hawkins, Schenectady, N. Y., assignor to General Electric Company. A signaling system using adjacent sources of current differing in phase.



856,414.—DYNAMOELECTRIC MACHINE.

856,466. BLOCK-SIGNAL SYSTEM. Laurence A. Hawkins, Schenectady, N. Y., assignor to General Electric Company. An alternating-current signaling system.

856,467. BLOCK-SIGNAL SYSTEM. Laurence A. Hawkins, Schenectady, N. Y., assignor to General Electric Company. Inductive windings cross-connect the rails on both ends of each block.

856,475. PRODUCTION OF CALCIUM ALLOYS. Franz von Kügelgen and George O. Seward, Holcombs Rock, Va. A molten calcium salt is electrolyzed with a cathode of fused zinc.

856,476. ELECTRICAL CONTROLLER. George Laird and John P. Todd, Manchester, England, assignors to Westinghouse Electric and Manufacturing Company. A circuit-breaker is interposed in the controller circuit.

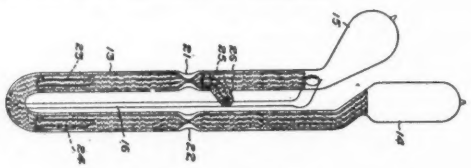
856,477. ALTERNATING-CURRENT MOTOR. Benjamin G. Lamme, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. A motor with a winding adapted to produce a plurality of poles.

856,483. AUTOMATIC GAS-FEED FOR VACUUM-TUBE LAMPS. Daniel M. Moore, Newark, N. J., assignor to Moore Electrical Company, New York, N. Y. An electromagnetic regulating gas valve.

856,484. AUTOMATIC GAS-FEED FOR VACUUM TUBES. Daniel M. Moore, Newark, N. J., assignor to Moore Electrical Company, New York, N. Y. A thermostatic gas valve.

856,497. ILLUMINATING MIRROR. Arthur D. Southam and Horace C. Hides, Hartford, Ct. Incandescent lamps are enclosed within a chamber attached to the mirror.

856,503. TROLLEY WHEEL. Charles F. Wilson, Brooklyn, N. Y. A wheel having a chamber for lubricant.



856,441.—MAXIMUM-DEMAND INDICATOR.

856,504. KEYBOARD TELEGRAPH-TRANSMITTER. Richard Wolters, Düsseldorf, Germany. A key having a contact rail and slide.

856,511. SIGNALING SYSTEM. George H. Bowen, Boston, Mass., assignor to Boston Automatic Fire Alarm Company, Boston, Mass. A watchman's recording system.

856,512. WIRE CLAMP. James Bowers, Caldwell, N. J. A slotted bolt clamp.

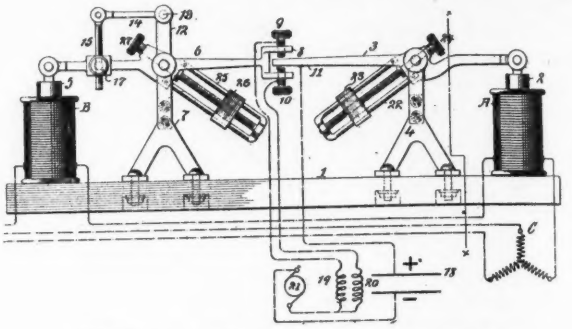
856,535. TROLLEY POLE FOR CONDUCTING ELECTRIC CURRENT TO VEHICLES. Robert Lindsay and John Lindsay, Dunedin, New Zealand. A telescoping pole.

856,540. STARTER FOR ELECTRIC MOTORS. William C. Mayo and John Houlehan, El Paso, Tex., assignors of one-third to George E. Briggs, El Paso, Tex. Propelling means are provided for moving the controller arm.

856,566. WINDINGS FOR ELECTRICAL APPARATUS. Miner Barcus, Schenectady, N. Y., assignor to General Electric Company. A transformer winding.

856,570. TELEPHONE SYSTEM. Frank B. Cook and James G. Nolen, Chicago, Ill.; said Nolen assignor to said Cook. A manual system.

856,583. BLOCK-SIGNAL SYSTEM. Laurence A Hawkins, Schenectady, N. Y., assignor to General Electric Company. An alternating-current signaling system operated by the moving train.



856,741.—LOAD EQUALIZER FOR GENERATORS.

856,602. ELECTRIC SPARKING PLUG. Charles E. Reed, Jr., Chicago, Ill. A plug with a tubular neck forming the sparking chamber.

856,604. ELECTRIC SELF-PLAYING VIOLIN. Henry K. Sandell, Chicago, Ill., assignor to Mills Novelty Company, Chicago, Ill. A device driven by a motor.

856,670. BLOCK-SIGNAL SYSTEM. Charles C. Anthony, Philadelphia, Pa. Single-track roads.

856,716. PHOTOGRAPHIC-PRINTING MACHINE. Hervey H. McIntire, South Bend, Ind. A timing device is attached for turning off the lamp.

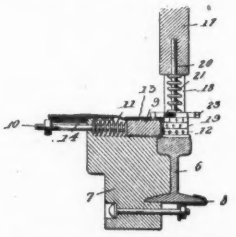
856,722. AUTOMATIC GRIP-CORD ADJUSTER. Otto Pedersen, Chicago Heights, Ill. A cord adjuster.

856,736. ELECTRICAL HEATER AND EXPANSION COIL. Milton H. Shoenberg, San Francisco, Cal., assignor by direct and mesne assignments, to Consolidated Electric Appliance Companies, Limited, San Francisco, Cal. The heater is inclosed within a hot conducting tube.

856,741. LOAD EQUALIZER FOR GENERATORS. Severn D. Sprong, Brooklyn, N. Y., assignor of one-half to Metropolitan Engineering Company. A device for equalizing the loads on plurality of generators.

856,755. ELECTRIC-LAMP SOCKET. Joseph Amon, New York, N. Y. A method of construction.

856,782. THIRD-RAIL COVER FOR ELECTRIC RAILWAYS. William F. Kemper, Chicago, Ill. A sliding rail guard.



856,782.—THIRD-RAIL COVER FOR ELECTRIC RAILWAYS.

856,794. PIANO PLAYER. Robert Morgan, Ellsworth, Kan., assignor of one-half to Emile E. Kolochney, Ellsworth, Kan. An electromagnetic device.

856,801. INSULATOR. Charles L. Peirce, Jr., Chicago, Ill., assignor to Peirce Specialty Company, Chicago, Ill. An insulator mounted on a metallic bracket.

856,807. ELECTRIC HEATER. Joseph S. Reynolds, Santa Barbara, Cal. The coils are attached to a heat-resisting plate.

856,837. TELEGRAPH APPARATUS. Victor C. Balding, Little Rock, Ark. A perforator for telegraph strips.

856,961. SPEED-GOVERNOR FOR ARMATURE SHAFTS, ETC. Edward B. Jacobson, Pittsfield, Mass., assignor to Pittsfield Spark Coil Company, Pittsfield, Mass. A centrifugal governor.